ELECTRICAL REVIEW

May 11, 1945

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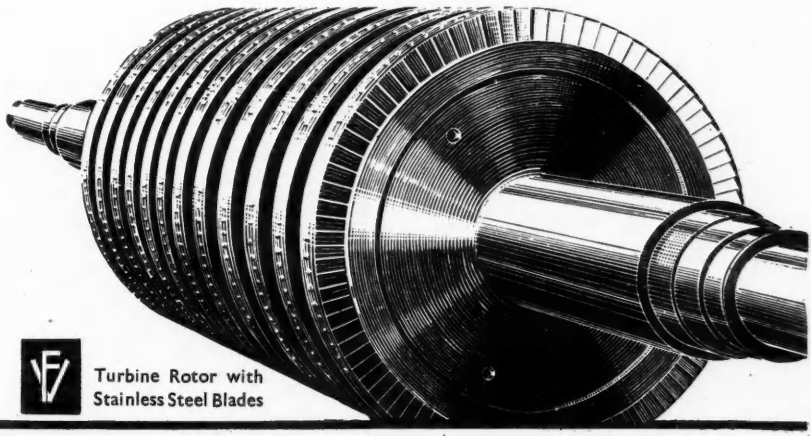

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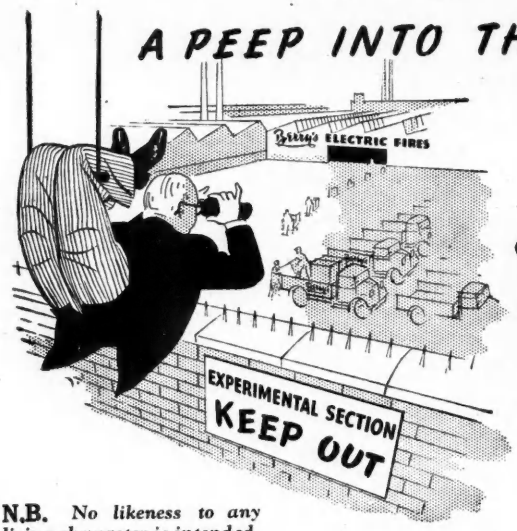

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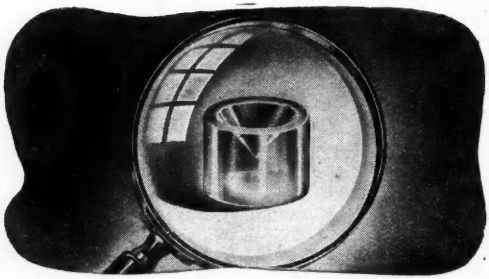

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVI. No. 3520. MAY 11, 1945 9d. WEEKLY

War and Peace

Electrical Industry's Key Position

WITH the formal declaration of cessation of hostilities in Europe comes the opportunity to consider in an atmosphere that is relatively calm, because more remote from the actual scene of battle, the ways and means by which electrical activities can best be switched over from armament production to meeting the normal needs of the public when the world war is ended with final victory in the Pacific. Electrical engineers are unlikely to suffer from the delusion that any peace worth having means merely an absence of foreign military aggression. They are in the fortunate position of being able to realise that the winning of the peace will depend increasingly on their own unrelenting efforts. This knowledge together with the inherent interest of their work provides them with the dynamic, which has been called "the moral equivalent of war," that is required for summoning all their energies to the service of their country.

National Reconstruction

Yet with all the will to take its leading place in national reconstruction and development, the electrical industry may well feel some uncertainty as to what will be required of it. Much that is of immediate moment to the industry perforce depends upon questions of Government policy, which itself is dependent upon the post-war international situation.

Some action will doubtless be taken, after the prior claims of full industrial electrification have been satisfied, in the direction of standardising distribution voltage and tariff structures, rationalising supply areas, and possibly generation, and making further provision for co-operative research. There will be urgent problems to tackle in the mass electrical equipment of new dwellings and in catching up with the normal growth of domestic load after five years of suspended animation. This may entail concentrating on models which lend themselves to rapid production, probably of pre-war types, and (of at least equal importance) easy installation with some modification in wiring methods to the same end. Rural areas and transport are among other matters that will probably come up for consideration.

Need for Export

That is only one aspect of the matter. Ultimate electrical progress in Great Britain is intimately associated with the ability of electrical manufacturers to secure unhampered export of their potential output. An urgent claim on their productivity will be provided by the needs of a devastated Europe, in whose prosperity our own is deeply involved, and this may entail some sacrifice on the part of consumers here.

The electrical industry is in an especially favourable position for meeting all the calls upon its resources that the future seems likely to make. Enjoying the advantages peculiar in each case to large, medium and small organisations, it has shown a remarkable degree of resilience, both before and during the war, in satisfying the varied demands on it. In addition to fulfilling the requirements of munition

production here, it has continued to supply equipment of all kinds to the Empire and Dominions and also to our Allies. Electricity's contributions to the war effort have been largely in the nature of an extension or adaptation of its ordinary functions and its return to the serving of constructive ends, reinforced by war-stimulated developments, should be free from the obstacles that will unfortunately confront many other trades.

Protective Devices

DISCUSSION of last week's two I.E.E. Installations Section papers on excess-current protection on medium-voltage circuits by Mr. R. T. Lythall (fuses) and Messrs. A. G. Shreeve and P. J. Shipton (relays) emphasised the outstanding importance of providing for open-phase and earth-leakage faults. Of these the second kind is the more important because of the accompanying risk of fire—a risk that increases with the size of installation—and of the greater number of those it affects. Some difference of opinion was evident as to whether earth-fault tripping or merely indication is generally more desirable, but not about the need for a wider realisation of the harm that may come from quite small current leakages.

The Law

IN view of the possibility of further legislation affecting electricity supply, some knowledge is desirable of how the industry is governed and the steps which led up to the present position. An outline of the subject was given in Mr. L. S. Atkinson's inaugural address as chairman of the I.E.E. Dundee Sub-Centre. Those interested should also take cognisance of some of the private Acts promoted by power companies in pursuance of the recommendation made by the Cross Committee of 1898. In these Parliamentary approval was first given to the supply of electricity over wide areas, thus making rural electrification possible, instead of practically confining the development within urban municipal boundaries.

Without Record

AUTHORS of papers presented before scientific and technical bodies have often nowadays to answer criticisms of incomplete treatment of certain aspects of their subjects by reference to the limits imposed by space considerations. While such restrictions are undoubtedly necessary in view of the quantity of paper required for the advance proofs circulated and for subsequent publication in the journal of the institution concerned, probably on their account much valuable data remains unrecorded. Could not authors be encouraged to deposit for reference in the library of the institution a full record of their work in typescript? The additional labour entailed would generally not be great, probably far less than in the subsequent condensation required for the printed versions of the papers.

Portable Tools

IN his report on electrical accidents during 1943 Mr. H. W. Swann, Senior Electrical Inspector of Factories, emphasised the need for ensuring that earthing connections on portable appliances have been made correctly and remain effective. The Electrical Contractors' Association has previously drawn attention to its members' responsibilities in this matter and it now recommends the affixing of labels to portable tools warning the user to make sure that the earth connection is in order and also stipulating that the tool is to be used only by the firm's employees. While it is not certain that this precaution would absolve the employers from all blame for possible accidents it should at least mitigate any penalties which might be imposed.

Flexible Connections

STANDARDISATION normally has in view more economical production or greater convenience to the user. It therefore finds no place in enforceable regulations that are designed to secure safety. Nevertheless non-standard articles may introduce risks even though individually they may be of good quality. In this issue Mr. K. M. Mackenzie draws attention to risks that may arise in factories from the near paradox of a too ready interchangeability of different types of plugs and sockets, which is potentially a contributing factor to the high percentage of electrical accidents that is associated with flexible connections. Works electrical engineers have, of course, to make shift with what they can get nowadays. But chance of danger can be reduced by segregation of different types of fittings that are used.

The G.P.O. During the War

Maintaining the Telephone and Telegraph Systems

IN general, the experiences encountered in the maintenance of the telephone and telegraph systems in the face of air attack have been very similar to those which have been met with by the electricity supply industry and which have already been described in the *Electrical Review*. The important difference, however, may be summed up by the word "intricacy." If, for example, a power station is hit by a bomb or damaged by fire, the boilers, condensers, alternators and even the switchboards and instruments are of a reasonably large size and stand a fair chance of being repairable.

Fulham telephone exchange received a direct hit

On the other hand a direct hit or a fire at a telephone exchange is almost certain to play havoc with the delicate equipment, particularly automatic exchange apparatus, and the masses of complicated fine wiring. Again, the repair of an electric cable is child's-play compared with dealing with a multicore telephone cable which may have as many as 1,400 pairs. Sometimes perhaps a hundred cables converging on a telephone exchange and lying beneath one roadway have been damaged by a single bomb. Damage was not confined to the limits of the bomb craters in the streets and often faults were found a considerable distance from the explosion. Plumbed joints have been destroyed as far as 200 yards from the bomb crater, and the centre conductor of a coaxial cable has been disconnected three joints away. While cables have sometimes been stretched, bent

A general view of the damage at Wood Street exchange

and flattened in a fantastic manner with no effect on efficiency, on other occasions faults have occurred, perhaps a considerable time afterwards, in cables which on inspection have appeared undamaged. Frequently, too, work on repairing damaged cables has been held up because of debris making access impossible.

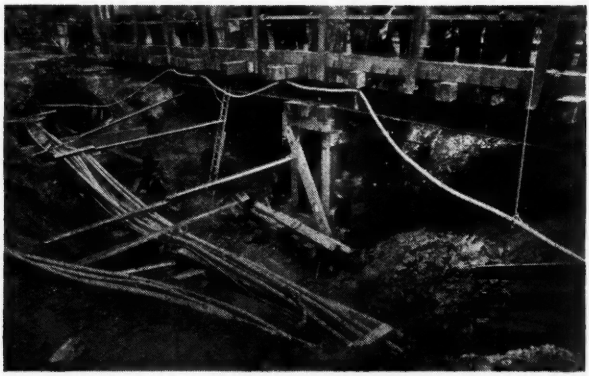
Plymouth telephone exchange

Improvisation has played a big part in carrying out temporary repairs. Often, to avoid a bomb crater, interruption cables have been run, usually in service troughing, from the nearest manholes or from shafts sunk down to the duct on each side of the crater. At other times bridges formed of poles or steel scaffolding have been employed to carry the interruption cables over the crater. Besides reconstructing manholes it has sometimes been necessary to build additional manholes in in the craters.

Unlike power stations, telephone exchanges and their equipment cannot, except in the case of a few steel-framed buildings, be claimed to be particularly suited to withstand the effects of bombing. Switchboards are usually placed on the top floors of exchanges to get the maximum amount of light. Even where a bomb has not scored a direct hit, it has often shattered windows and thrown up clouds of dust, which settles on apparatus and prevents it from operating. Vacuum cleaners are not always sufficient to remove this dust and so use has been made of portable spraying equipment employing "Dekalin," a non-toxic solution.

Thanks largely to well-trained fire-fighting parties, only rarely has any appreciable damage been done to exchanges by incendiaries. Two methods have, however, been successfully developed for dealing with equipment that has been corroded owing to the mixing of water used in fire fighting with the battery acid, namely, shot or sand blasting and the use of dental type rotary brushes.

For use when the electricity supply has failed, portable charging sets (in four sizes) have been brought into service, the Engineering Department's pre-war fleet of 160 portable generators with a total capacity of 1,200 kW having been increased during the



A crater in Charing Cross Road showing temporary road bridge and telephone cables being repaired

war to 275 with a capacity of 2,500 kW. In addition to these portable sets a large reserve of stationary engine generating sets has been formed. At eight zone centres sets with a total capacity of 2,000 kW are installed. In addition twelve 50-V 1,500-Ah battery sets have been provided for use with semi-automatic emergency exchanges, while existing plant at fifty exchanges has been converted to work on the float system to meet the increasing load.

To ensure that subscribers with "immediate action" lines can originate calls in all circumstances, emergency arrangements have been made whereby their circuits are segregated into groups with sole access to a number of automatic first-selectors. In case both main and emergency exchanges should be disabled, a scheme has been devised whereby their circuits can be diverted to satellite or "fringe" exchanges.

Damage to overhead equipment has been insignificant compared with that occurring to exchange buildings and underground cables. There have, however, been instances of poles being burnt by incendiaries or broken or deflected by h.e. bombs, though they often escaped damage by the latter even when quite close. Aerial cables have been severed not only by bombs, but by anti-aircraft shells and barrage balloons.

Repairing damaged cables at the Bishopsgate exchange, London

The most severe blow suffered by the Post Office telecommunication system occurred during the "Second Fire of London," when severe damage was sustained by both the Central Telegraph Office and the Wood Street buildings containing three automatic telephone exchanges (London Wall, Metropolitan and National), as well as the Headquarters exchange and hundreds of repeaters for circuits passing through to terminate at Faraday Building. Although the Central Telegraph Office handles more than a quarter of the total telegraph traffic of the country, services were fully restored in alternative accommodation within three weeks.

Repair work in progress near Cadby Hall, Hammersmith

By diverting circuits to spare equipment in neighbouring exchanges and by re-establishing the old Clerkenwell exchange (which had been taken out of service when the automatic exchange was opened) and renaming it "Kelvin," the more important subscribers affected by the damage at Wood Street were speedily reconnected and several special telephone bureaux for the use of the general public were brought into service, the first opening on January 9th. By January 21st service had been restored to 700 subscribers, the Kelvin exchange opening on the following day. Altogether the restoration work involved, among other things, the laying of 7·3 miles of maximum size cable in the street, 235 joints to main cables, 250,000 pairs of wires jointed and 88,000 pairs of wires tagged and jointed on main frames, and a 100,000 soldered jumper joints.

All the more remarkable, therefore, with all these difficulties is the way in which, with a very much depleted personnel, telephone and telegraph services have continued to function so satisfactorily and with so little interruption, and at the same time have been extensively expanded to meet wartime demands. A large number of telephones was required for the Service Ministries and the civil defence organisation, the whole of the air-raid precautions system being linked with the Post Office system.

At the height of the raids 15 million local calls a week were dealt with in London alone, and, despite appeals to the public to use long-distance lines as little as possible, toll calls throughout the country have increased from about 1,400,000 to 2,400,000 a week and trunk calls from 800,000 to 1,600,000 per week since the beginning of the war.

Apart from the maintenance of the telephone and telegraph network many new radio services have been brought into operation, while new problems in radio and other aspects of telecommunications have been solved. Teleprinter working has been extended to all but the lightly loaded telegraph routes where telegrams are disposed of by telephone.

No praise is too high for the work of the telephone operators and the repair and maintenance personnel. To keep the telephone system working operators have remained at their posts during the height of the bombing, usually, as already mentioned, on the top floor of the telephone exchange building.

Innumerable cases have been recorded of personal bravery and devotion to duty on the part of the Post Office workmen, who have been among the first on the scene of an "incident" and have frequently worked, with raids still in progress, amid bombs and A.A. shell splinters, close to unexploded bombs and buildings in imminent danger of collapse, in floods and escaping gas. The Submarine Section deserves special mention for its work in dangerous circumstances around the coasts.

We thank the *Post Office Electrical Engineers' Journal* for permission to use certain material contained in this article.

Aids to Public Speaking

THE last of this session's informal meetings of the Institution of Electrical Engineers was held on April 23rd, when MR. P. G. A. H. VOIGT, B.Sc., opened a discussion on "Electrical Aids to Public Speaking." He recalled the Institution's first electrical aid to speakers when, some years before the present war, a piece of apparatus, described as the "Speaker's Friend" was placed on the chairman's desk in the lecture theatre. Its function was to indicate to speakers in any part of the theatre whether they could be heard. The apparatus showed a light when the loudness of the speaker's voice was adequate. It was a help, but undoubtedly few speakers relied upon it.

Mr. Voigt said it was usual to see pictures of people addressing the public, hidden behind an array of microphones. He maintained that something far less conspicuous should be used and showed two types of small microphones, one of which was a ribbon type made for laboratory use.

An important factor was the loudspeaker, which, broadly speaking, could be either directional or non-directional. His own view was that the audience should not be aware that electrical aids were being used and he deplored the effect when loudspeakers were heard from a different direction from that of the speaker. Tone controls in amplifiers could be very helpful owing to the differences of response in different halls. Referring to the use of reflectors with microphones, he showed how a horizontal reflector which he had made could be "aimed" at the speaker to improve audibility.

In the discussion attention was drawn to the value of attenuating the lower frequencies in speech, it being pointed out that when the human voice is amplified beyond its original intensity, the lower frequencies are proportionally louder and tend to mask the higher frequencies. Complaint was made that not enough had been done to improve public address systems. Speakers using a microphone should endeavour to address themselves at least to the two front rows of the audience, as in this way the effect throughout the hall would be improved. The need for collaboration between sound-engineers and architects in the case of theatres, music-halls and large buildings was emphasised.

Mr. Voigt in his reply said that maintenance was always a difficult matter. It seemed to be thought that installations would work for years without attention.

Newcastle Trolley-bus Plans

AT a town's meeting held recently, the Newcastle-on-Tyne City Council's plans to convert the remaining tram routes to trolley-buses and operate trolley vehicles over other routes, were approved. The chairman of the Transport Committee (Alderman G. Dixon) explained that the plan would cost £785,000, while to keep the tram system and buy 200 new trams and renew 50 miles of tram track would cost £2,000,000. The transport manager (Mr. H. C. Godsmark), replying to a question, said that trolley-buses were slightly cheaper to run than petrol buses.

Wallsend Town Council is taking steps to have the Bill amended so that the consent of the Wallsend Council must be obtained to additional routes in its area.

Plugs and Sockets in Factories

Too-Easy Interchangeability a Source of Danger

By K. M. Mackenzie
(A. Reyrolle & Co., Ltd.)

MUCH has been said and written lately on the subject of plug and socket connectors, especially on the inconvenience in the home caused by the non-interchangeability of various sizes and types in common use. There is another matter, however, of a rather opposite kind, which affects almost every factory in the country, and which is serious because life and limb are very often in danger. Here it is too-easy interchangeability and not non-interchangeability that is at the root of the trouble. Attention is drawn to the subject because publicity appears to be the best method of minimising the danger.

First let us consider the possibility of making the outer casing of apparatus alive by inserting a wrong plug into a socket. For example, some two-pole-and-earth-pin plugs can have their three pins inserted into the three live contact-tubes of some three-phase sockets in common use. Such sockets are usually connected to a 440-V supply, and the safety earth-wire in the flexible lead and the framework to which it is attached thus become alive at full voltage. Accidents from this cause have occurred.

Risk of Overhang

The operation of inserting the plug appears to be quite normal to any average workman, but the result might easily prove fatal, either from direct shock or indirectly from a resulting fall or stumble. Another frequent cause of trouble, including burnt hands, is the arcing that occurs when overhanging live pins come into contact with the earthed metal casing of a socket. Every electrical man will recall accidents from this cause, and the number of unrecorded burns or shocks, and of fortuitous "near misses," must far exceed the recorded accidents, which merely arouse temporary and local interest.

The term "overhang" is understood by plug and socket designers and other specialists, but an explanation is offered here to assist the user in recognising this dangerous snag. If one pin only of a plug can be inserted into one live contact-tube of a socket so as to leave another pin exposed and overhanging the socket, the exposed pin may be alive and dangerous. The danger can only be detected by the engineer on site after a trial of all the types he has in use, and it will be found that plugs with unshielded pins are the ones that it may be possible to insert in the way described.

The Government is, of course, well aware of all this through its factory inspectors, and the Electricity Regulations made under the Factory and Workshop Acts refer explicitly to the dangers that have been mentioned. For example, an extract from the memorandum on Regulation 13 reads:

> "Where portable apparatus has to be earthed, the connector may have to provide for the earth connection in addition to the circuit connections. It should be so arranged (*a*) that in plugging in and out, the earth connection is made before, and broken after, the circuit connections, and (*b*) that, in plugging in, the connections cannot be wrongly made. It should not be possible to put the earth contact of the plug portion into connection with a live contact of the socket portion, as the metal work of the portable apparatus would then be made live, very possibly bringing about just such an accident as the earthing is intended to prevent."

Another extract from the memorandum on the same Regulation reads:

> "The most common accident in the use of connectors is for the user to get his hand severely burned when putting in the plug of the connector."

There is, however, nothing in the Regulations to prohibit the use of a mixture of different types of plugs and sockets in the same establishment, and many accidents result from this cause. Most of the plugs and sockets available are in themselves safe and sound *when they are used with their proper complementary parts*, but the varied nature of portable equipment, radiators, tools, lamps, and so on inevitably brings together many different makes of connectors.

Need for Careful Selection

The vagaries of weather, the ever-changing needs of production, and the unpredictable whims of individuals, all contribute to the moving about of equipment, and it is the resultant mixing of the connectors that can, and does, bring about very dangerous conditions. It is evident, therefore, that those responsible for industrial electrical installations must exercise their authority and be vigilant in selecting and controlling the types and sizes of plugs throughout their establishments, eliminating the dangerous ones.

The range of plugs and sockets now on the market can be divided broadly into two main kinds, namely, the metalclad protected type, designed exclusively for industrial use, and the open-pin bakelite type, usually fitted in domestic or office premises. Large quantities of the latter are also used, however, in

factories, especially in many of the light industries. If these two distinctive kinds of fittings could be kept strictly apart in service much of the danger would be eliminated, and many accidents avoided.

In the absence of regulations to ensure this separation it is left to electrical installation engineers themselves to provide for it. Plug and socket manufacturers cannot control the problem, because they do not know when and where the various types will come together, and the hands of the Government would appear to be tied because individual forms of plugs and sockets cannot be classed as unsafe in themselves, when properly used. It is unreasonable to condemn a socket because someone has inadvertently inserted, or tried to insert, a wrong plug. It is equally unreasonable to blame either the plug or the unfortunate operator.

The responsibility must rest with the engineer who permits a situation to exist whereby interchangeable fittings can produce danger. He is already responsible for the safety of operatives in respect of the screening of running machinery, the elimination of noxious fumes, the provision of adequate lighting, and so on; and the plug and socket problems discussed are simple in comparison.

Finally, it is suggested that a memorandum from the Factory Inspectorate of the Government on this subject would be most timely, in view of the many new factories now being built for post-war industrial activities.

Cable Testing

Recently Developed Methods

LOCALISATION of faults in low-voltage cables, with special reference to manufacturing procedure, is the subject of a paper written by Mr. J. H. SAVAGE (W. T. Henley's Telegraph Works Co., Ltd.) for the Transmission Section of the Institution of Electrical Engineers.

The paper deals mainly with special methods developed within the last few years for determining insulation and conductor faults in cable-making factories, where a very high order of accuracy is required without resorting to "burning" the fault, which may destroy the evidence necessary for preventing a recurrence. Another reason for exact localisation is the avoidance of undue mutilation or cutting of the cable, which causes wastage or makes repairs difficult. The usefulness of some of the methods described is not confined to low-voltage cables or to factory requirements, but outside determinations do not usually favour precision testing.

Practical limitations to well-known methods of ascertaining the positions of faults along cables are discussed first and then some new tests, which are capable of being carried out with great accuracy, are outlined. They include a DC valve-volt meter circuit for core-to-sheath insulation faults, audio-frequency search methods for open circuits and radio-frequency tests for conductor defects.

In most cases the basic principle is that of a search device which is passed along the cable to cause, or detect, local changes in electrical characteristics, instead of the more usual procedure of making tests at the cable ends for calculating the fault position from length measurements.

The need for improved means of measuring sheath potential differences led to a method being devised (U.K. patent No. 556,884) whereby exploring contacts moved along the cable sheath cause indication on a DC valve voltmeter, which is energised by a 6-V car-type battery. The circuit is an inversion of that employed for fall-of-potential tests; this method depends upon the measurement of very small voltages, the highest convenient sheath current being about 20 A and, within wide limits, the accuracy of localisation is independent of cable length. Very high resistance faults have been located to within less than one inch on ten-mile lengths of armoured cable in coil form, which degree of exactitude is believed to be unobtainable by any other method.

Radio-frequency detection of conductor defects, which are difficult to find after the insulant has been applied, will be required at infrequent intervals only. The construction of special apparatus may not be justified, but radio apparatus used for other test purposes may sometimes be adapted for this purpose.

Fault location by reflection of wave, surge and pulse effects is also mentioned. In the present state of its development this means appears to be mainly suited to long overhead lines and submarine telephone cables. In such cases the risk of breakdown of important service justifies the provision of somewhat expensive and complicated equipment when skilled personnel is available to make the tests and interpret the results.

Institute of Fuel Students' Medal

To encourage the reading of papers by student members of the Institute, also those taking courses at universities and technical colleges, the Council of the Institute of Fuel has decided to make an annual award of a medal together with a prize consisting of books and instruments to the value of £5. Particulars are obtainable from the secretary, Institute of Fuel, 30, Bramham Gardens, London, S.W.5.

Unremunerative Consumers

Operation of "Purse's Index" in relation to Guarantees

By F. S. Naylor
(Borough Electrical Engineer, Gravesend)

IN the *Electrical Review* of March 23rd, Mr. F. W. Purse discussed various points arising out of two ratios derived from data he had collected relating to undertakings throughout the country, *viz.* (*a*) annual expenditure/total capital expenditure, and (*b*) annual revenue/expenditure on mains and services only. The second ratio should be given a name (I suggest "Purse's index"),

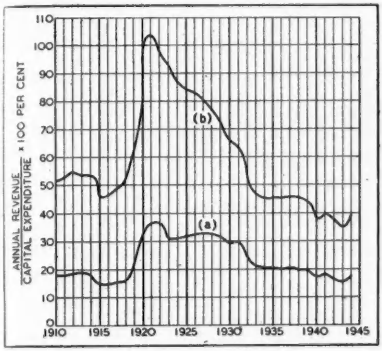


Fig. 1.—(a) Total expenditure. (b) Capital expenditure on mains and services only

because it is a sufficiently new and perhaps important idea to warrant a means of easy reference.

Ratio (*a*) was used by Kennedy and Noakes (*I.E.E. Journal*, August, 1933) as a measure of efficient use of capital. Annual revenue is the revenue for the year under consideration, *e.g.*, ending March 31st, 1944, and capital expenditure comprises all capital assets from the inception of the undertaking to the year under consideration. It is true that much of this capital expenditure has been paid off and the loan charges no longer appear as an ingredient of the price per kWh, which decides the annual revenue. Comparison with the procedure adopted by a company undertaking is, however, relevant. When a company borrows £100 of share capital, it makes no difference whether the borrowing is in, say, 1899 or 1944 because, as soon as it has been borrowed and presumably turned into capital works, the undertaking has incurred the liability of paying some shareholder a dividend on the £100 and this in turn would require a specific revenue for all time to reap the profit required to pay the dividend. On these grounds most supply engineers would probably recognise index (*a*) as a measure of the efficient use of total capital, but whether they would be prepared to recognise Purse's index is another matter.

In ratio (*b*) the denominator is that part of the total expenditure on mains and services only from the commencement of the undertaking up to the year under consideration. It deals only with averages and has other limitations, so that misleading conclusions may be drawn from it unless care is exercised.

The two indices (*a*) and (*b*) are plotted in Fig. 1 for Southwark electricity undertaking over a period of thirty-four years. Purely from a commercial angle the indices might be high because the profit per kWh is high, which might be good for business, but from the consumer's point of view the lower the better. With the small margin of profit that an electricity undertaking may make, revenue can be regarded as practically equal to annual costs and abnormally low figures such as are shown in Fig. 1 are not necessarily good from any angle. During the war years Southwark did not pay its way because the population fell to about half and conditions in consequence were extraordinarily difficult.

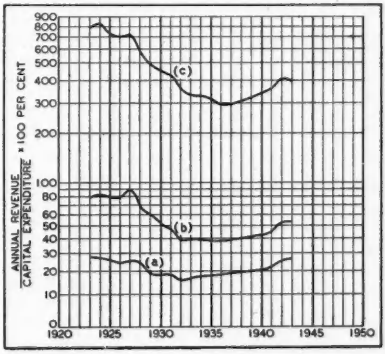


Fig. 2.—(a) Total capital expenditure. (b) Capital expenditure on mains and services only. (c) Capital expenditure on meters only

To indicate certain limitations to Purse's index I have taken the matter one step further and considered only the expenditure on meters. Using this item for the denominator the ratio (*c*) becomes annual revenue expenditure on meters only. Indices (*a*), (*b*) and (*c*) have been plotted in Fig. 2 for Gravesend undertaking for the years 1923 to 1943.

From index (*c*) one might conclude that, under present conditions, for every £100 spent on meters an annual revenue of at least £400 from the kWh these record should be obtained. As an ordinary slot meter costs about £4, following the strict argument an annual revenue of £16 should be obtained from each consumer; otherwise the situation on the undertaking is becoming worse. This extreme case is introduced not to condemn but only to emphasise the need for care, especially since meters are responsible for only a fraction of the capital expenditure and we are dealing with averages. Expenditure on mains and services, however, constitutes about half the total capital expenditure and should therefore be a fairly reliable basis on which to draw conclusions.

Dealing with Purse's index, if the individual index for new business is lower than the average, then the stability of the undertaking can be maintained only when existing consumers are increasing their revenue at a continually compensating rate. A supply engineer must be satisfied that he stands a fair chance in due course of bringing up the revenue from a new consumer to the existing average. If not, then he has every right to deal with the matter differently. For example, where temporary houses are supplied with with gas equipment throughout except for electric lighting, this state of affairs will be maintained to the end of the life of the houses and there is therefore no chance of revenue increasing.

Consequently supply undertakings should step very warily in offering to do anything beyond their statutory obligation for the local authorities concerned. The idea of allotting lighting only for the whole life of these dwellings is the very negation of the progressive anticipation upon which the financial stability of electricity undertakings is built, and the maximum contribution in capital toward the cost of making these meagre supplies available should be demanded. Even if payment of the whole cost be demanded the undertaking will still lose money on the deal. At least that is what Purse's index shows.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Supply Authorities as Contractors

I WOULD again direct Mr. Moss' attention to the provisions of Clause 48 of the 1926 Act under which municipal electricity undertakings are empowered to "sell electric lines, fittings, apparatus and appliances for lighting, heating and motive power and for all other purposes for which electricity can or may be used and to install, connect, repair, maintain and remove the same." These undertakings are restricted from manufacturing any of the items so stated or from selling them except to a consumer or a person who intends to be a consumer of electricity supplied by them, or even to a contractor except for the same purpose. In addition, the prices charged to a consumer must not be less than the recognised retail prices and to a contractor not less than the recognised trade prices. Finally, these trading operations have to be self-supporting.

Now Mr. Moss (or any other contractor) is not under any such obligation; he may carry out work and sell his goods to anyone anywhere. Can anyone argue that the supply undertaking in this respect has no competition, is a protected industry, and is in a powerful and safeguarded position? Even the question of recognised retail or trade prices is safeguarded, as the 1926 Act requires the Electricity Commissioners to appoint a committee (which they have done) to determine any question so raised, and in addition there is in existence a Fair Trading Council which has issued various statements setting out such prices.

I assume Mr. Moss will contend that supply undertakings have no competition in regard to the sale of electricity, but the public are not compelled to use the public supply of electricity for lighting, heating, cooking, power and other purposes. They can install their own plant and use coal, gas or oil for this purpose, or they can use such mediums direct and will do so unless the public electricity supply is cheaper and more convenient. In addition to this competition, electricity undertakings are controlled as to the maximum prices which they may charge, and must not give preferential treatment for the same class of supply, and are compelled to furnish a supply to any premises within fifty yards of their distribution mains whether it is a paying proposition or not.

Finally, Mr. Moss claims that the phenomenal development since 1926 has rendered the Act out of date. The pamphlet, from which I quoted in my last letter, sets out at length the reasons why the special powers should be conferred upon municipal undertakings; those reasons, far from being out of date, could be greatly reinforced because the powers have been responsible for the electrical development to which Mr. Moss refers.

*London, W.C.*2. F. W. PURSE.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE first occupant of the Chair of Electrical Engineering at Cambridge University established under the auspices of the Institution of Electrical Engineers is to be **Dr. E. B. Moullin.** He is at present Donald Pollock Reader in Engineering Science at Oxford. Dr. Moullin, who was born in Dorset in 1893, holds the M.A. degree of both Cambridge, where he was a University lecturer from 1920 to 1929, and Oxford, where he has been a Fellow of Magdalen College for some years.

Dr. E. B. Moullin

Dr. Moullin's work has been largely in the radio field, particularly measurement. In 1922 he invented and patented the original thermionic voltmeter which was manufactured by the Cambridge Instrument Co., and in 1926 he published the first work on radio-frequency measurements. He also developed a standard ammeter for very high frequencies as well as other radio-measurement devices. The subjects of his studies have included background noises in radio receivers and radio aerials. Dr. Moullin is a vice-president of the I.E.E. and was chairman of the Wireless Section in 1939-40. He is also a member of the Radio Research Board.

Mr. Thomas Coates, senior engineering assistant in the Liverpool undertaking, has been appointed deputy city electrical engineer at a salary of £1,400 per annum rising to £1,700. At the meeting of the City Council on May 2nd at which the Electric Power & Lighting Committee's recommendation was approved a councillor wanted to know why the post had not been advertised and asked whether a new principle was being introduced. The deputy-chairman of the Committee said that there was no obligation to advertise a post of this kind as this was a promotion, but if the position was advertised, all replies would have had to go to the Ministry of Labour and this would have complicated the whole procedure.

The Committee of the I.E.E. South Midland Students' Section has nominated **Mr. S. A. Hunter** (Electric Construction Co., Ltd.) for the chairmanship for the next session.

Sir James S. Pringle, K.C.B., O.B.E., M.I.E.E., late Director of Electrical Engineering, Admiralty, has undertaken, with the permission of the Admiralty, to act in an advisory capacity to the Metropolitan-Vickers Electrical Co., Ltd.

Mr. W. R. Allcock, deputy borough electrical engineer of Stockport since 1931, has been appointed borough electrical engineer, to succeed **Mr. G. H. Oldroyd,** as from August 25th next. Mr. Oldroyd was due to retire on pension last year, but owing to war conditions he consented to continue in office in a temporary capacity.

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Mr. W. T. Andrews, constructional and development engineer with the Poplar Electricity Department, has been appointed chief engineering assistant at a salary of £810 per annum.

Mr. F. L. Hallard has joined Suflex, Ltd., as Northern representative and is working from the Manchester office at 2, Brazil Street.

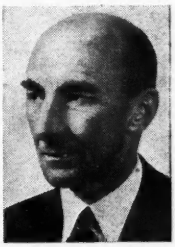
Mr. Felix Levy, a director of George Cohen Sons & Co., Ltd., is relinquishing the position of Assistant Director of Scrap Supply, Ministry of Supply, to return to his company.

Mr. A. H. Spindler, B.Sc.Tech., A.M.I.E.E., for twelve years divisional manager and chief electrical engineer to George Cohen, Sons & Co., Ltd., has been appointed managing director of A. Cooksley & Co., Ltd., woodworking machinery specialists. He was at one time in Canada with the Harland Engineering Co., Ltd., engaged on electrical work in connection with the Welland Ship Canal (by-passing Niagara). Mr. Spindler plans to extend the manufacturing side of Cooksleys with particular attention to the electrical aspect as connected with woodworking machinery.

The Minister of Supply has released **Mr. A. G. E. Briggs** from the post of Deputy Controller of Iron and Steel Supplies. His services, however, will continue to be available in an advisory capacity. **Mr. K. G. Lampson** succeeds him as Deputy Controller.

The Hon. Geoffrey Cunliffe, a director of the British Aluminium Co., Ltd., has been appointed president of the newly-formed Aluminium Development Association. **Mr. Horace W. Clarke,** managing director of James Booth & Co., is vice-president.

We reported last week that **Mr. C. M. Cock** had been appointed chief electrical engineer to the Southern Railway. Mr. Cock was born in Melbourne and received his engineering training at the Newport Locomotive Carriage and Wagon Workshops of the Victorian Railways. During the last war he served in the Royal Navy. He became an engineer lieutenant in January, 1919, and left the service towards the end of that year to join the staff of Merz and McLellan.



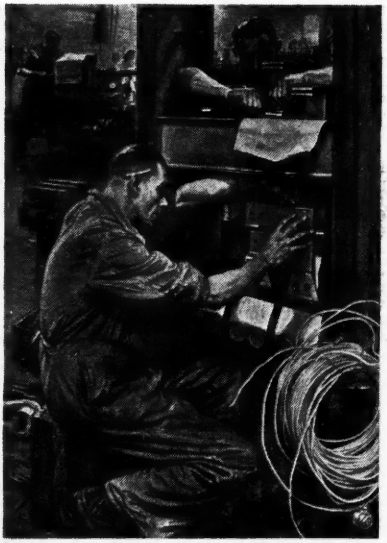
Mr. C. M. Cock

While with Merz and McLellan Mr. Cock worked as personal assistant to the late Mr. E. P. Grove, the firm's chief resident engineer on the electrification of the Melbourne suburban lines of the Victorian Railways and the construction of Newport "B" power station for the Victorian Electricity Commission. On completion of these works in 1924 Mr. Cock went to India as one of Merz and McLellan's supervising engineers on the electrification of the G.I.P. Railway suburban

lines, the B.B. and C.I. Railway suburban lines and the main lines of the G.I.P. Railway to Poona and Igatpuri. In 1929, when the electrification was completed he joined the G.I.P. Railway, holding appointments as distribution engineer, rolling stock engineer, traction superintendent and divisional superintendent for the area including Bombay.

In addition to his railway duties Mr. Cock, in 1940, organised the Bombay Harbour motor boat patrol manned principally by local yachtsmen and was in command until he was "lent" to the Royal Indian Navy, but while serving afloat overseas as lieut.-commander, R.I.N.V.R., it became necessary, owing to the increasing pressure on Indian railways, to recall him to railway duties early in 1942. He is a member of the Institution of Electrical Engineers and an associate member of the Institution of Engineers (Australia).

At this year's Royal Academy Exhibition which opened on Saturday there is a painting in oils by Dame Laura Knight, R.A., entitled "Skill." The picture was completed at the Birmingham works of George Ellison, Ltd., where the artist chose as her subject a scene in the bay where the drawout distribution switchboards are assembled. The picture,



"Skill," a painting by Dame Laura Knight, R.A., at this year's Royal Academy Exhibition

which measures 56 in. by 40 in., is later to be exhibited in other parts of the country. The accompanying illustration is reproduced from a photographic copy of the painting received from Walter Judd, Ltd., publishers of *Royal Academy Illustrated*.

A football match between married and single members of the Contracts Department of A. Reyrolle & Co., Ltd., was played recently in aid of the Electrical Industries Benevolent Association.

Mr. F. S. Jones, of Birkenhead, has been appointed chief clerk and administrative assistant with the Eastbourne Corporation Electricity Department.

Rotherham Corporation Transport Committee has appointed **Mr. E. V. Dyson,** of Stalybridge, as rolling stock superintendent at a salary of £550 per annum.

Mr. A. C. Baker has been elected president of the Bristol Electric Club in succession to **Mr. A. J. Newman.** At the Club's eighteenth annual meeting a presentation of an oil painting was made to **Mr. F. R. Ashmead** who was secretary for many years until the suspension of the Club's activities in the early days of the war.

Mr. E. Robson is retiring from the chairmanship of Pinchin, Johnson & Co., Ltd., on June 30th.

Mr. A. E. Hammersley, area manager, West Kent, is chairman of a committee set up by the County of London Electric Supply Co. and its associate companies to deal with inquiries regarding the reinstatement of employees upon their discharge from the Forces. Other members include **Lieut.-Col. N. W. S. Halsey,** welfare officer, and **Mr. R. Stubbins** of the legal department.

The G.E.C. Well Wishers' Club, formed early in the war to maintain contact with the men and women employees of the company in the Forces, last month despatched its 30,000th parcel. The occasion was marked by compounding an extra large parcel the recipient of which was chosen by ballot. The "draw" was made by Mr. Leslie Gamage, vice-chairman of the G.E.C. and president of the Club, who also packed the parcel. The winner was Private A. H. Mansell, a former member of the Despatch Department at Magnet House and now serving in the Mediterranean area.

The annual sales conference of the Sloan Electrical Co., Ltd., was held at the Waldorf Hotel, London, on April 18th and 19th when some thirty of the executive and sales staff were present. At this function it was announced that **Mr. F. C. Guildford,** who is chairman of the company, has taken over the managing directorship. **Mr. W. J. Bensley,** who has been sales manager for many years, has been appointed general manager.

Mr. F. M. Barnett, A.M.I.E.E., has retired after forty-two years' service with Bradford Corporation Electricity Department. Entering the Department in August, 1903, as charge engineer, he later transferred to the consumers' sub-department, of which he was appointed head in 1914. The Bradford Civil Defence Emergency Committee has placed on record its appreciation of his services in connection with the air-raid warning system.

Mr. P. H. Coales has retired from the Witton works of the General Electric Co., Ltd., after thirty-seven years' service with the company. He had held the post of chief draughtsman of the Switchgear Department since 1911. Mr. Coales served his apprenticeship with J. W. Haswell & Co., Leicester, and before joining the G.E.C. held positions with various electrical engineering firms in the Midlands. During his

service with the G.E.C. he was actively associated with the development of switchgear of every type. He is succeeded by **Mr. S. R. Spruce**, A.M.I.E.E., who has been with the G.E.C. for thirty-five years, during fifteen of which he was Mr. Coales' chief assistant.

Mr. J. W. Spark, who has been city electrical engineer of Bath since 1925, is retiring from that position at the end of August next.

Mr. H. E. Walker presided at a dinner in Birmingham recently to celebrate the jubilee of Walker Bros. (Electrical Engineers), Ltd. With him were his sons and co-directors Major G. N. Walker and Mr. N. C. Walker and his nephew, Mr. E. Walker, another director, whose father was one of the founders of the firm.

Mr. W. Dean and **Mr. P. L. Crawford**, joint managing directors of W. H. Dean & Son, Ltd., sheet metal workers and aluminium founders, etc., Burnley, have been appointed to the board of Burco, Ltd., while **Mr. D. K. Ward** and **Mr. L. F. Hiles** (Burco, Ltd.) join the board of W. H. Dean & Son.

Sheffield Corporation Electricity Committee has appointed **Mr. W. H. Smith**, senior and relief shift charge engineer at Blackburn Meadows power station, as assistant power station superintendent at a salary of £683 per annum.

Mr. Arthur Willis has been presented with a long-service testimonial by the directors and management of the English Electric Co., Ltd., from whose Stafford works he has retired after an aggregate of forty-eight years' service. The presentation was made by Mr. Milligan, manager of the Stafford works.

Sir George Nelson, president of the Federation of British Industries and chairman and managing director of the English Electric Co., Ltd., and **Mr. D. B. Williamson**, B.Sc., A.M.I.E.E., have been elected to the Council of the Town and Country Planning Association. The Earl of Lytton, chairman of Central London Electricity, Ltd., is president of the Association.

The Hoover Sports Club Dramatic Section has recently presented its second show, "The Distaff Side," by John Van Druten. Margaret Popham (assistant producer) took the part of Alex Millward, and Leslie Keatley (producer) that of Gilbert Blaize. Other players were Phyllis Brown, Flora Stabbs, Renee Roberts, Alan Dawson, Marion Fulton, Edward Hall, Cynthia Hedger, Robert Simpson, Cyril Tomkins, Peggy Wilcock and Jean Wilsher. The stage manager was Phil Hanham and the orchestra was conducted by J. Tierney.

Mr. N. T. Evans has been nominated for the chairmanship of the I.E.E. Bristol Students' Section for 1945-46.

Mr. S. J. Smith has been elected chairman and **Mr. W. H. Howard** vice-chairman of the Dundee Sub-Centre of the I.E.E.

Obituary

Mr. A. V. M. D'Arcy.—We regret to announce the death at the age of seventy-one of Mr. Arthur Vivian Mervyn D'Arcy who, before his retirement in June, 1943, had been in the service of the British Thomson-Houston Co., Ltd., for forty-eight years. After being educated at the Regent Street Polytechnic, London, Mr. D'Arcy served an apprenticeship with Spagnoletti & Crookes, electrical engineers and contractors, joining the B.T.H. Co. in 1895 as a tester in the meter department, then situated at Westminster. In 1902 he was transferred to the Rugby works, in charge of standardising work and the experimental laboratory. When the meter department was moved to Willesden in 1916, Mr. D'Arcy went there as head of the meter department and standardising laboratory. He returned to Rugby in 1931 to take charge of the instruments and meters in the research laboratory, and retained this position until he retired. Since his retirement he has occupied his time in the pursuit of his chief hobby, radio experimenting.

Mr. T. R. Renfree.—We regret to record the sudden death on April 30th of Mr. T. R. Renfree, Companion I.E.E., A.M.Inst.C.E., senior technical sales engineer with the British Electric Transformer Co., Ltd. Mr. Renfree was born at Redruth and following his early education and engineering training in Cornwall he took his electrical training at King's College, London. After a short period on the educational staff at the College he went into industrial engineering. He was for some years with the British Westinghouse Co., Ltd., Trafford Park, before joining the British Electric Transformer Co., Ltd., in 1907 as senior technical sales engineer, a position which he held until his death. He leaves a widow and daughter.

Mr. A. Dickinson.—We regret to record the death in hospital on May 1st of Mr. Arthur Dickinson, A.M.I.Mech.E., superintendent of the Agecroft power station. Mr. Dickinson, who was fifty-five, joined the Salford municipal electricity undertaking as steam engineer and works chemist in 1926 and was appointed superintendent at Agecroft three years ago.

I.E.E. Luncheon

SOME 280 members attended the informal luncheon of Measurements Section of the Institution of Electrical Engineers at the Connaught Rooms last week. Dr. W. G. Radley, chairman of the Section, presided and remarked that the nearness of the end of the war must not mean the termination of effort, for there was much ground to be regained in restoring the amenities of life that had come to be expected. The Measurements Section claimed to be unique in that all the other specialised sections depended upon the ability to make measurements.

Mr. T. G. N. Haldane, vice-president, deputising for the president, Sir Harry Railing, referred to the increasing importance of the specialised sections and the parts they could play in the corporate life of the I.E.E. Recent revisions of the bye-laws had given the Sections increased voting representation on the Council and premiums offered for I.E.E. and section papers had been made equal. Reconstruction of the post-war world would largely depend on engineering and so measurement would exert a great influence, particularly in grappling with shortages of many kinds during the next few years, which would necessitate the best possible instrumentation.

Mr. H. W. Grimmitt returned thanks on behalf of the chairmen of the other technical Sections and the health of the chairman was proposed by Mr. H. L. Kirke.

I.E.E. Council's Report

Committees to Advise on Various Problems

THE report of the Council of the Institution of Electrical Engineers for the year 1944-45, which was to be presented to the annual general meeting yesterday (May 10th) shows that the number of elections to all classes increased to 2,639 during the year, the number of applications for election and transfer having been 5,113. The total membership (12,573 corporate) reached 26,665, being a net increase of 2,107.

By-law revisions have become effective, particular interest attaching to amendments modifying the procedure of election and transfer of members. Changes have also been made in the constitution of the Council.

More than £10,000 has already been received towards the financial resources of the Professional Engineers Appointments Bureau, which is sponsored as a separate entity jointly by the three senior Institutions.

Following a recommendation of the I.E.E. Post-war Planning Committee a permanent Research Committee has been appointed " to advise the Council on matters connected with electrical research which affect the Institution, to assist in the selection of Institution representatives on external bodies concerned with research, to help such representatives and, when necessary, to provide liaison between them and the Council on matters of policy."

Further substantial progress has been recorded by the Codes of Practice Committees and final draft codes have been prepared in respect of lightning protection, private generating plant and the lighting of dwellings, while the drafting of a code on the installation and maintenance of flame-proof equipment is well in hand.

Radio Interference

In response to a request from the Postmaster-General the I.E.E. Committee on electrical interference with broadcasting has been reconstituted to review its previous recommendations and consider modifications that may have been made desirable by the introduction of new forms of high-frequency equipment. This Committee's deliberations are to be pressed forward so that its findings may be of assistance in the framing of legislation.

Acceding to a request from the Air Registration Board an I.E.E. Committee has been appointed to undertake, as a matter of urgency, the preparation of regulations for the electrical equipment of civil aircraft. At the request of the Air Ministry another Committee has been set up to formulate, with high priority, technical airworthiness requirements for the design and installation of radio equipment in civil aircraft.

The average attendance at ordinary meetings in London grew to 228 and local Centre activities have been well supported. A Sub-Centre at Rugby has been formed and new Installations Groups established in the North-Western and Western areas.

The membership of the Installations Section is 1,968 with an average attendance of 135; Measurements Section 1,088 and 98; Radio Section 2,600 and 202; Transmission Section 1,767 and 99; but attendance at the informal meetings dropped to 73.

The Central Register

Through the electrical section of the Central Register of the Ministry of Labour 1,758 members have been placed in work of national importance and 743 applications have been dealt with for technical commissions in certain branches of the fighting forces. Some 4,100 members of all classes have been listed as being in military service.

War Office correspondence courses (14,350 registered for engineering subjects) are being revised to satisfy the requirements of the new associate membership examination and a special refresher course has been introduced. There will not be any more enrolments for Ministry of Education engineering cadetships, but there are still a number of courses to be completed; 3,545 candidates have already been examined in Part I and 1,665 in Part II of the course while 1,239 cadet diplomas have so far been awarded. Successful candidates are granted exemption from a large part of the associate membership examination. The latter was held at 22 centres at home and 33 overseas, the number of candidates being respectively 774 and 503. In addition, special arrangements were made at 112 centres for 1,432 candidates. Revised regulations for this examination become effective in the autumn of this year and a detailed schedule of accepted qualifications will be published this summer. As a guide to interpretation of the new syllabuses a list of books is obtainable for 6d. post free.

Theses were submitted by 48 candidates as an alternative to examination, 21 of which were recommended for acceptance. The numbers of National certificates and diplomas awarded were 1,865 in England and Wales and 101 in Scotland, while in Northern Ireland 15 higher certificates were awarded.

During the year under review 6,573 readers, of whom 1,560 were non-members, used the I.E.E. library, and the lending library issued 3,963 books to 1,635 borrowers.

Low-Capacity Switches

Slow Breaks for AC Circuits

By R. W. J. Cockram, A.M.I.E.E., A.I.Mech.E.

CONVENTION is one of the most serious obstacles facing a designer. Thus, early observations of the life of DC switches showed that the larger the arc the shorter the working life. This led designers to minimise the duration of the arc, thereby lessening the burning of contacts by heat from the arc energy. Switches were consequently provided with quick-break mechanisms which drew the contacts apart under heavy spring tension. Hence was built up a convention that a quick-breaking action was desirable to give long working life, and the greater the " crash " with which the switch contacts separated, the higher the reputation of the switch.

With the advent of general AC supply in this country, this form of control persisted mainly on the grounds of convention and the considerable costs involved in changing manufacturing methods. Incidentally, the distraction caused by the metallic click of the quick-make-and-break action of the tumbler switch calls for attention from planners of post-war houses, a slow-break quick-make action being more easily silenced.

Basic Theory of Slow-Break Switch

If, by chance, the contacts are separated quickly at the instant of zero current (100 times per sec. on a 50-cycle supply) no arc is formed; but should the break be on or just before the crest of the wave, root two times the normal RMS current is broken. Furthermore, should the load controlled be inductive, then an induced EMF will be superimposed as a transient on the EMF wave, thereby increasing the current to be broken. Should the instant of breaking, or rather attempted break, occur during the rise of current towards maximum value, these conditions will again be amplified. These effects may be observed by opening an AC circuit by means of an air-break switch having quick-break mechanism, the arc set up for different breaks varying considerably.

If the contacts be arranged to open slowly, arcing will be reduced to small intensity, since the instant of break is not now important. Should the instant of break occur at the peak of the wave, the gap between contacts is very small (due to slow travel of contacts) and the voltage quickly falls to zero when the circuit is automatically broken. On the next wave building up the contacts have usually moved sufficiently far apart to preclude the restriking of the arc. If the instant of break occurs at zero, the rising voltage will probably restrike the arc, which will persist for possibly a single half cycle before being extinguished at the next zero. In all cases speed of break controls the arc energy set up between the contacts, but normal hand operation of the switch is found to give the best results.

Slow-Break Rotary Switch Mechanism

In an article which appeared in the *Electrical Review* of August 21st, 1942, it was shown that the quick-break mechanism used with rotary switches connects various terminals together in the registering positions by rotating a contact bridge assembly through angular displacements of 90 or 60 deg. for four- and six-position switches respectively. In slow-break mechanism, instead of the spring-drive feature there is a direct drive with control springs arranged to impede rotation on opening the contacts and to assist rotation on closing.

On rotating the central spindle (1) in Fig. 1 the star wheel (2) forces the spring

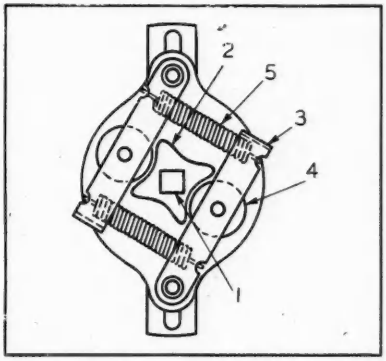
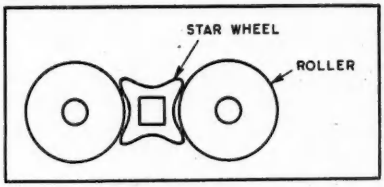


Fig. 1.—Slow-break rotary-switch mechanism showing (1) centre spindle, (2) star wheel, (3) carriage, (4) rollers and (5) tension springs

carriage arms (3) apart by means of the rollers (4). This motion extends the tension springs (5) until the points of the star are reached, thereby severely impeding the rotation of the spindle. Immediately on passing top dead centre of the star wheel points, the resistance force exerted by the springs is changed to one of assistance, and the spindle is quickly rotated to the next position. This quickly moves the rotating contact bridges in the disc build-up section

to the next operative position. Since the centre spindle is one solid member giving direct drive to the contact bridges the speed

Fig. 2.—Incorrect design of roller star proportions
Fig. 3 (right).—Correct design



of break is slow, due to the impeding action of the springs. On the contacts being well separated the action of the springs ensures quick engagement of the contacts, thereby raising the conductivity of the mating surfaces to a maximum in the least possible time.

Design Features of the Mechanism

The formulating of the correct star-wheel contour and engaging rollers is largely a matter of drawing-board development on an almost completely trial and error basis. Certain features, however, are imperative, as follows:—(1) The points of the star must be of rugged proportions to resist wear; (2) the rollers must give positive location at the roots of the star; (3) the mechanism must reciprocate with the same operational characteristics in each direction; (4) the entire mechanism must fall reasonably within the space occupied by quick-break mechanism; (5) the springs must be worked well within their elastic limit; (6) assembly and manufacture must be of the utmost simplicity to meet the demands of quantity production.

To meet condition (1) the star wheel for the four position switch was developed from a range of basic squares, the sides of which were cut as far as possible from the apices to cover requirement (2). This, in turn, decided the radius of the engaging roller, which must be greater than that of the depression in the star wheel, as will be seen from Figs. 2 and 3. The equivalent force diagram shown in Fig. 4 shows how the stabilising moment is controlled by the proportions of these two components through the angle α, which, if increased, will reduce the necessary initial tension of the springs.

From conditions (1) and (2) it would appear that the larger the star wheel and roller the more positive will be the location of the switch positions. Conditions (3) and (4), however, severely limit these dimensions, for (3) gives a general restriction to space occupied, and (4) requires that the operating arms lie normal to the sides of the star. For smaller switches the fulcrum centres of the arms were swung out but for the six-position and larger switches the framebolts could be used as bearing spindles and to offset the hole for the shaft passing through the star wheel as shown in Fig. 1. All that remained was to obtain optimum relative dimensions of star wheel and rollers to satisfy point (5), at the same time maintaining the widest possible limits to facilitate manufacture.

A prototype switch of this design was in satisfactory condition after a mechanical test on a motor-driven gear box for one million operations. After electrical tests involving 10,000 operations on full rated load of 60 A at 250 V satisfactory operation was still obtained on full load without renewal of contacts. For these tests a speed of 40 RPM was used, and the handle was allowed to travel to each new position under control of the tension springs after the rollers had been turned to the top of the star-wheel points. In the event of both tension springs failing the switch may still be operated—a feature of particular advantage for airborne applications where mechanisms are not permitted to depend entirely upon springs.

The complete action of a switch fitted

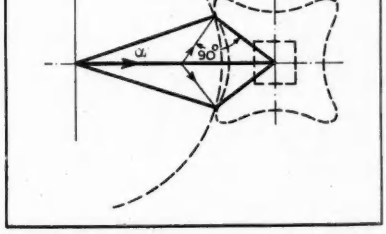


Fig. 4.—Force diagram showing component of initial spring tension giving stabilising moment

with this type of mechanism is entirely out of the operator's control. The handle may be turned in any manner and the mechanism always functions with the same characteristic

quick break and make. The converse of this has been referred to, at times, as a disadvantage of slow-break mechanism, but with the considerable change in resistance of the springs assisting the handle movement, only one operation is usually necessary to show the user that finger and thumb operation is most suitable.

Where any degree of inductance is present in an AC circuit beyond that normally associated with an induction motor, quick break is usually more suitable than slow break, because voltage and current components are not in phase and the induced EMF set up on changing the current conditions of the inductive circuit with slow break is often sufficient to increase the restriking voltage so that the arc persists over a number of cycles, and in this way does much more damage to the contacts than that which is caused under quick-break conditions.

These last considerations give an advantage to quick-break mechanism regarded as universal gear. However, the increasing use of alternating current has made possible the achievement of better performance from control apparatus of the rotary switch type by means of the slow-break mechanism.

The author is indebted to Santon, Ltd., for permission to use the drawings illustrating this article and to recount the stages involved in the development of the mechanism described.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

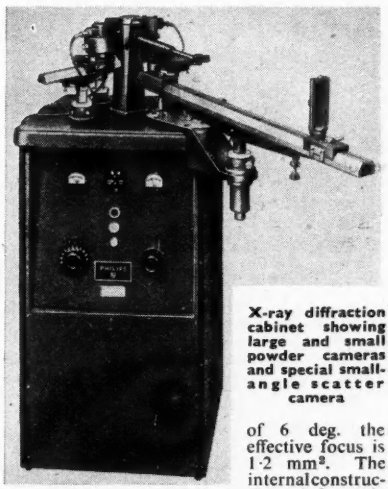
Diffraction Outfit

NEWLY developed X-ray diffraction apparatus, suitable for both university and industrial laboratories, is announced by PHILIPS LAMPS, LTD., Century House, Shaftesbury Avenue, London, W.C.2.

This Type 41.D outfit is self-contained, the circuit being arranged for a centre-earthed transformer and two oil-immersed rectifying valves. The base of the cabinet houses the high voltage generator as well as the tube-filament transformer, a full-wave rectified output being delivered to the cathode of the X-ray tube at high voltage. The control panel on the front of the cabinet is conveniently sloped and indirectly illuminated, permitting stepless variation from 10 to 60 kVp, which is directly indicated, while the filament current is stabilised and can be regulated, being indicated on a 0 to 50 mA meter. In addition the control table incorporates a main switch, overload circuit-breaker, press-button high-voltage switch, pilot light and an hour meter (10,000 hours and reading to 1/10 hr.) for recording exposures and tube life.

The top of the cabinet is formed from an accurately machined iron casting, which provides a flat instrument surface right up to the tube housing. The latter is constructed from a beaded bronze casting, providing complete X-ray protection, and accurately machined so that every tube inserted takes up precisely the same position. This means (since the tubes themselves are also accurately constructed) that the necessity for re-alignment of cameras is eliminated. The four window faces are machined to an angle of 6 deg. to the vertical (to correspond with the angle of emergence of the maximum X-ray beam) and provided with four tapped holes so that if desired special devices (monochromators) can be semi-permanently and rigidly accommodated. A rotatable disc carrying the necessary filters is built into each window housing so that the appropriate filter can be immediately brought into position. The main tube support and the window housings are water-cooled to avoid any drift of the X-ray beam due to thermal variations during long exposures.

The X-ray tubes have four windows of Lindemann glass, the thickness of which is kept to a close tolerance, thus ensuring maximum and constant output. The focus, which is located very precisely with respect to the tube housing, is 12 x 1·2 mm so that by taking off at an angle



X-ray diffraction cabinet showing large and small powder cameras and special small-angle scatter camera

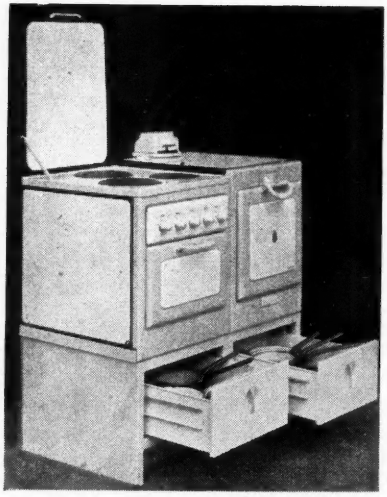
of 6 deg. the effective focus is 1·2 mm². The internal construction of the cathode assembly ensures that the radiation is uncontaminated. Target materials of W, Mo, Cu, Fe, Co and Cr are available. The maximum continuous ratings are 1,000 watts for W, Mo and Cu, and 600 watts for Fe, Co and Cr. The tubes are inserted into the housing and secured by four screws, the water and electrical connections being automatically made; tubes can be changed in a matter of minutes.

The water-cooling system for the tube,

window housings and high-voltage generator is automatically switched on and off, and a protective relay shuts off the apparatus the moment the water pressure gets too low or too high. A comprehensive selection of accessory equipment is also available to accommodate five types of camera and four power sockets in the cabinet are provided for driving the camera motors and other equipment.

Moffat Cooker Modifications

In common with other electric cooker manufacturers, MOFFATS, LTD., Blackburn, do not expect to have their new models on the market until probably a year after the cessation of hostilities with Germany. In the meantime, however, the opportunity is being taken to make various minor modifications to pre-war designs.



Modified horizontal Moffat cooker

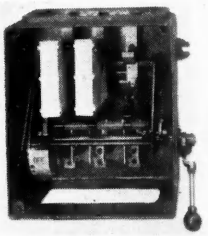
By the substitution of drawers for legs in the pre-war horizontal type unit illustrated above a cooker is produced which compares favourably with the latest ideas both in design and appearance.

Switches for Inductive Loads

To comply with B.S. 861, medium-voltage air-break switches must be suitable for substantially non-inductive loads. The standard "HH" range made by A. REYROLLE & CO., LTD., of Hebburn-on-Tyne, is good for this duty up to 600 A, but conditions of load and operation often require that switches should be suitable for making and breaking inductive and/or capacitative loads, such as AC motors, condensers, and welding transformers, so a new range has been developed expressly for this duty.

Each phase is fitted with an arc-control device and there is a screen inside the lid to prevent arcing to the earthed case. The main high-pressure butt contacts are of heavy copper section, with strong backing springs. Arcing contacts are also fitted to make before and break after the main contacts, thus considerably reducing wear on the latter.

The mechanism has a high-speed quick-make and quick-break action operated by heavy springs, which prevent hesitant closing and hold the contacts firmly in the closed or open position. A flag indicator is fitted to show when the switch is "on" or "off," through a glass window in the lid. Three ratings of 100, 200 and 400 A are available and they are respectively interchangeable with standard "HH" units of the same ratings.



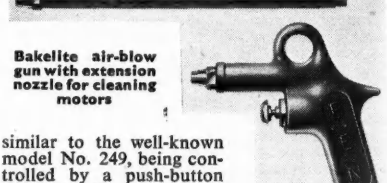
Reyrolle switches for inductive and capacitative loads

Low-voltage Soldering Iron

Having completed a large Ministry of Supply contract for specially designed soldering irons of 25 W at 6 V rating, the ACRU ELECTRIC TOOL MANUFACTURING CO., LTD., 123, Hyde Road, Ardwick, Manchester, 12, has decided to market the same model for general use, as there seems to be a demand for a low-voltage battery type. It is in appearance exactly the same as the 45-W "Pyrobit" model designed for wireless instrument makers, differing only in respect of the heating element and copper bit.

"Gun" Blower

An addition to the range of compressed air blow guns made by B.E.N. PATENTS, LTD., High Wycombe, Bucks, is an insulated version which is specially designed for the electrical industry. It is supplied with an 8-in. extension nozzle to facilitate blowing dust out of motors and similar uses wherever a risk of electric shock exists. The new gun, which is formed of moulded bakelite, is in all other respects similar to the well-known model No. 249, being controlled by a push-button with a handle shaped to fit snugly into the hand. The nozzle and valve are renewable and the former is available in three alternative sizes. A ¼ in. diameter male screwed hose connection is fitted and provision is made to enable the tool to be suspended from a hook when not in use.



Bakelite air-blow gun with extension nozzle for cleaning motors

COMMERCE and INDUSTRY

Shorter Working Hours. Fuel Policy and Smoke Abatement.

Young Electricians' Wages

THE National Joint Industrial Council for the Electrical Contracting Industry announces an amendment of the rates of wages in respect of labour under twenty-one years of age which comes into operation on the third pay-day in May. The rates in relation to those of journeymen are increased as follows:—Category II. Age 16, from 15 to 19 per cent. Age 17, from 20 to 25 per cent. Category III. Age 16, from 20 to 25 per cent. Age 17, from 27½ to 35 per cent. The rates for other age groups remain unaltered.

To the above rates is to be added the current amount of the cost of living (war) adjustment applicable to the age groups concerned. In accordance with a further agreement dated April 28th the amounts applicable to Categories II and III as from the third pay-day in May are to be: under 18 years, 33⅓ per cent. of the journeyman's cost of living (war) adjustment. Between 18 and 21 years, 66⅔ per cent.

Unions and Tir John Appointment

It was reported at last week's meeting of the Swansea Electricity Committee that the A.E.U. was threatening to place an embargo on overtime at Tir John power station unless a member of that Union was chosen for the position of instrument mechanic instead of a member of the Transport and General Workers' Union. The Committee decided to support the appointment of the better man.

Engineers for Colonial Service

It is announced that arrangements for the appointment to the Colonial Service of engineers who are normally required to possess academic or professional qualifications and also of qualified architects and town planners, are now to be conducted by the Colonial Office. Information regarding appointments of this nature will in future be obtainable from the Director of Recruitment (Colonial Service), 15, Victoria Street, S.W.1. The arrangements were formerly undertaken by the Crown Agents for the Colonies.

Iron and Steel Distribution

The Iron and Steel Control of the Ministry of Supply announces that any " M " form authorising the acquisition of " steel " is now valid for the acquisition of any quality or composition (including alloy and high-speed steel) unless it bears a condition to the contrary.

Hours of Work

In 1942 the hours of work in the building and civil engineering industries were limited by a Direction under Defence Regulation 56AB to a maximum of 60 hours per week on weekdays. The industries and the Government consider that it is not practicable to maintain these very long hours and heavy overtime for an indefinite period. Accordingly the Minister of Works, after discussion with both sides of the two industries, has accepted their unanimous recommendation that the working week should be reduced throughout the country to a maximum of 54 hours. A Direction under the Defence Regulation to this effect is being issued and will come into force on May 14th. The general permission for Sunday work in London will also cease as from that date. No excess of 54 hours or Sunday work will be permissible other than the present specified exceptions or by special permission of the Ministry of Works.

Canteen Staffs' Wages

The Minister of Labour and National Service has made the Wages Board (Industrial and Staff Canteen Undertakings) (Amendment) Order, 1945, which extends the scope of the Industrial and Staff Canteen Undertakings' Wages Board so as to bring within it certain workers employed in connection with the provision of food or drink or living accommodation provided wholly or mainly for workers covered by the Industrial and Staff Canteen Undertakings' Wages Board Order, 1944 (No. 266).

Hammersmith Showrooms

When the Hammersmith Electricity Department's showrooms, offices and workshops in Uxbridge Road were seriously damaged by enemy action in 1940, adjacent premises were taken on a temporary lease. Recently the Electricity Committee has been considering the post-war erection and extension of its premises and has negotiated unsuccessfully for the acquisition of shops and land adjoining the site of the original showrooms. In the circumstances efforts have been made to find a suitable alternative site on which to build entirely new and up-to-date premises and an opportunity has arisen to purchase the site of Arlington House, Uxbridge Road. The price is £7,500, and the Finance Committee has approved the acquisition of the property.

New Zealand Imports

The latest abstract of statistics issued by the New Zealand Government shows that last year the Dominion imported electrical machinery and equipment to the value of £3,852,000 compared with £2,329,000 in 1943 and radio apparatus to the value of £836,000 compared with £437,000.

Smokeless Zones

The establishment of smokeless zones and a national fuel policy to ensure the best use of coal in new housing and damaged areas was proposed by Mr. Arnold Marsh, general secretary of the National Smoke Abatement Society, in an address at Glasgow last Friday. Mr. Marsh said that the rational thing to do was, first, to adopt a national fuel policy that would ensure the best possible use of coal, and then plan all reconstruction in complete harmony with that policy. Speaking on the creation of

smokeless zones, he said it was proposed that in suitable areas of our towns, especially in the central business areas, rebuilt bombed districts, and zoned industrial areas, any emission of smoke should be prohibited by making it a statutory nuisance. This could be achieved with little difficulty in the business areas, where industrial premises and dwellings were normally absent, and could readily be planned for in new and rebuilt areas.

Licensing of Philips' Patents

The *Journal of Commerce* reports a statement by Mr. Otto Schairer, vice-president of the Radio Corporation of America, that the R.C.A. is considering the advisability of an arrangement with Philips' Incandescent Lamp Works, Eindhoven, Holland, which will enable the R.C.A. to continue to license other companies under Philips' patents. As reported last week, the 20-year contract between Philips and the R.C.A., General Electric and Westinghouse Electric is due to expire on July 1st.

Precision Engineers and Export Trade

A number of the leading precision engineering concerns have formed a new company, the British Engineers' Small Tools & Equipment Co., Ltd., for the purpose of developing their export sales. The organisation is intended to supplement existing agency arrangements and satisfactory export or overseas agents will not be displaced but will have the assistance of the new company. The companies concerned are the Brooke Tool Manufacturing Co., Ltd., the Coventry Gauge & Tool Co., Ltd., A. A. Jones & Shipman, Ltd., F. Pratt & Co., Ltd., Taylor, Taylor & Hobson, Ltd., and E. R. Watts & Son, Ltd. The chairman is Mr. H. H. Harley (Coventry Gauge & Tool Co.) and the company has offices at Buckingham House, Buckingham Street, Adelphi, W.C.2. (Telephone: Temple Bar 0958/9.)

South Australian Inquiry

The South Australian Government has set up a Royal Commission to inquire into and report upon the supply of electricity by the Adelaide Electric Supply Co., Ltd., and "all matters connected therewith and the question whether further legislation relating to the company is desirable." The chairman of the Commission is Mr. Justice Reed, of the Supreme Court of South Australia, and the other members are Mr. J. W. Wainwright (nominated by the Government) and Professor A. L. Campbell, Adelaide University (nominated by the company). The company's nominee is Bonython Professor of Law and graduated with honours as Bachelor of Mechanical and Electrical Engineering at Sydney University.

On-load Tap Changing

At a meeting of the Coventry Electric Club on May 1st, Mr. G. A. P. Jewiss read a paper dealing with the modern fully automatic on-load tap changing transformer. The paper was illustrated by slides and a colour film. The author pointed out that with the growth of power stations and transmission systems, the internal reactance years ago was kept as low as possible to keep the voltage drop to a minimum, but reactance was now recognised as a valuable aid in limiting short-circuit currents. To overcome the voltage drop due to this reactance and to obtain the desired flexibility of voltage control under normal variations of load, it was increasingly necessary to-day to be able to adjust the transformer voltage ratio with the transformer on load.

A brief historical survey covered the evolution of the present day equipment and showed that with mercury switches in conjunction with copper-to-copper contacts (at present fitted to transformers up to 15 MVA) maintenance had been reduced considerably.

E.D.A. Bulletin

Reports of the British Electrical Development Association's annual meeting and luncheon appear in the April number of the "E.D.A. Bulletin." Another feature is an account of the operation of an all-electric school kitchen by Mr. P. Wardle, chief engineer, Cannock U.D.C. Electricity Department, in which the connected load is 97 kW, including 81 kW of cooking equipment. The figures given show that in the second week of operation 848 meals were served with a total electricity consumption of 210 kWh, costing an average of 0·205d. per meal. This issue also contains, as usual, reports of the Centres' activities and the names of members of the Council for 1945-46.

Australian Imports

The following are the values, published in Canberra, of the chief groups of electrical goods imported into Australia during the second half of last year with a note of increase or decrease (only in the case of cable and wire) compared with July–December, 1943.

Classification	Jun.-Dec. 1944 £ (000)	Inc. or dec. £ (000)
Dynamo electric machines ..	525	+ 284
Telephone and telephone switchboards	486	+ 151
Covered cable and wire ..	417	− 169
Batteries and accumulators ..	45	+ 27
Filament lamps	44	+ 20
Other electrical machinery and appliances	1,379	+ 257

Northern Ireland Electrical Wholesalers

Considerable progress has been made by the Electrical Wholesalers (Northern Ireland) Association since its formation just over a year ago. The main task of the Association, which we are told includes all the leading electrical wholesalers in the area, is to ensure a smooth transition from war to peace by close collaboration with the various Government Departments, transport and railway companies in an endeavour to secure adequate supplies of all classes of electrical products for distribution to the electrical trade. To further this end marked progress has also been made with several kindred associations and with certain manufacturers and groups of manufacturers in England.

The Association is also working in close harmony with the local E.C.A. and joint meetings are held regularly every month at which all problems of common interest are freely discussed. This joint body, which also includes representatives of manufacturers with branches

in Belfast, has accepted the Fair Trading Agreement as the basis of all discussions. Perhaps the most notable feature of these meetings has been the broad attitude adopted by all sides which has certainly avoided the "dog in the manger" attitude sometimes encountered at meetings of this kind.

The secretary of the Association is Mr. R. S. Neilson, 53, Chichester Street, Belfast, and manufacturers interested in the Northern Ireland market are invited to communicate with him.

Works Visit

On April 26th the Lord Mayor and Lady Mayoress of Birmingham (Alderman and Mrs. W. T. Wiggins-Davies) together with their daughter, Miss Joan Wiggins-Davies, paid a visit to the works of William McGeoch & Co., Ltd. They were received by Mr. William McGeoch, managing director, and Major and Mrs. Percy McGeoch. During the tour of the works the Lord Mayor inspected the works fire brigade and after lunch and a concert by E.N.S.A. artistes, he responded to an address of welcome by Major McGeoch.

The Lord Mayor of Birmingham at William McGeoch & Co.'s works. With him are Mr. William McGeoch, Miss Joan Wiggins-Davies, Major Percy McGeoch and Mr. C. Andrews

Stores Control

A 30-page booklet entitled "Stores Control" by W. Nelson Wright, stores controller at the Fitzroy Works of Frederick Braby & Co., Ltd., should prove of particular interest to those in charge of engineering stores. It is obtainable from Richard Madley, Ltd., Newton Works, Fitzroy Court, Tottenham Court Road, London, W.1, price 2s.

Fire-proofed Doors

Wood doors and bulkheads have been submitted to resistance-to-fire and spread-of-flame tests conducted at the testing station of the Fire Offices Committee by officers of the Building Research Station at Garston, Herts., of the Department of Scientific and Industrial Research. The tests were made for the Timber Fireproofing Co., Ltd., 81, Cannon Street, London, E.C.4, in accordance with British Standard Definition 476-1932 (building materials and structures) and indicate how certain grading and classification conditions may be satisfied by treating the timber with "Oxylene." The latter is the company's registered name for a fireproofing process that consists of impregnation with a mixture of mono-ammonium phosphate and borax.

Trade Publications

English Electric Co., Ltd., Stafford.—Illustrated publication (TD/101) describing Diesel-electric locomotives for railways, the first of which went into service in Great Britain in 1934; by 1941 the number built had reached 178 and some are in service in the Sudan, South Africa, Australia and Brazil.

Macrome, Ltd., King Street, Enderby, near Leicester.—Bound catalogue of 344 pages with index and fully illustrated for reference to almost every type of cutting tool and drill, including unusually complete information about sizes, pitches, angles, equivalents and alternatives the purchaser is likely to want to know. Also 20-page brochure dealing with soft-faced hammers, mallets and hand saws.

Siemens Electric Lamps & Supplies, Ltd., 38, Upper Thames Street, London, E.C.4.—Illustrated price list (Z.156) briefly specifying intake house-service units suitable for flush or surface mounting and of two types for accommodating either a quarterly or prepayment meter together with rewirable fuses and accessories.

Trade Announcement

Easco Electrical, 6–8, Brighton Terrace, London, S.W.9, ask us to mention in connection with their advertisement in our issue of April 20th that they can only deal with trade inquiries for their "Rectostats."

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections can be entered within one month from May 2nd:—

FLOOROLA. Class 9. No. 630,995. Electric waxing, polishing and scrubbing machines for domestic use, and parts thereof not included in other classes.—Floorola Products, Inc., York, Penn., U.S.A. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, W.C.2.

MINIBANK. Class 9. No. 632,254. Electric switches.—A.B. Metal Products, Ltd., Hatton Works, Great South-West Road, Feltham, Middlesex.

Views on the News

Reflections on Current Topics

A WEEK or two ago it was briefly reported in the British newspapers that the first German coal was being supplied to the Allies. And yet I have seen in the March 31st issue of the American *Electrical World* a picture of the generating room of the Karl Alexander coal mine at Basweiler, the caption under which says:—" The town, 12 miles north-east of Aachen, was captured last October by the U.S. First Army and within three weeks the German miners were back at work producing coal for the Allies." In view of our own coal position we might have had such heartening information earlier; who held it up?

* * *

Public ownership, which is so often advocated nowadays, can take various forms. A large part of the electricity supply industry is already publicly owned, being in the hands of local authorities, but many advocates mean nationalisation when they talk of public ownership. For instance, Mr. Herbert Morrison in a recent speech, referring particularly to electricity supply, said, according to *The Times*, " The only question was whether this common public service was to be handed over to public ownership and management or whether the country was to tie itself into knots in order to keep private ownership—or municipal ownership for that matter—in the picture." This places Labour members of borough councils in a quandary. For instance, at Swansea the Socialist Electricity Committee has declined to support nationalisation of the local undertaking. As reported in the *Western Mail*, one of the aldermen there said that the town should not sacrifice the advantages it had earned by its foresight in building a generating station of its own. But many companies have built generating stations too.

* * *

It is customary to refer to the hotel and catering " industry," but very few of us look upon it as industrial in the generally accepted sense. Nor do electricity supply authorities, who class hotels and restaurants as " commercial " for the purpose of their tariffs. Yet at the recent annual meeting of a London company concerned in this type of business the chairman complained that the cost of the unit, particularly in London, was high and " compared unfavourably with the cost of current supplied to other industries." He went on to say that with progress on modern lines it was probable that the consumption of electricity would increase considerably and the charge against income would be a very serious problem. He said nothing of the savings to the company which electricity would bring about in other directions. In this he was in line with a good many other people who judge electricity entirely upon price and have no regard to its service.

* * *

A new name has appeared in the domestic appliance field, Clifton Aircraft, Ltd., I am told that the Appliance Department of this concern has secured a licence to convert a part of its Lytham (Lancs) factory from the production of aircraft parts for the post-war manufacture of electrical domestic appliances. What is described as a first-class team of engineers and salesmen has been gathered together and the Board of Trade has been asked for accommodation in a Government factory in the area, sufficient for the employment of 600 people, or alternatively, for permission to build a model factory at the seaside. The company is already producing electric irons and " Streamline " breakfast cookers and it proposes to follow these up with domestic cookers, water heaters and various types of fires.

* * *

The production by the Brush Electrical Engineering Co., Ltd., in collaboration with Mavor & Coulson, Ltd., of " Joy " shuttle cars for collieries is another reminder of the interdependence of the coal and electrical industries. In this country not only is over 95 per cent. of electricity generated by means of coal but if the level of coal production is to be restored and increased much more electrically-operated mining machinery will have to be employed. It is indeed essential for the electrical industry to assist to its utmost in coal production, for without doing so the whole future of electrical development and the improved standard of living that follows will be jeopardised.

* * *

There is much to be said for the E.C.A. proposal to affix a " water-slide " transfer upon appliances which are taken to members for repair and are not fitted with proper earthing arrangements, urging the owners to consult their electrical contractors before using them. Nevertheless two thoughts occur to me. The first is: What will the consumer think (and say) when he finds his kettle, iron, or whatever it is, thus decorated? And then, supposing he consults his electrical contractor, what will his reaction be to any suggestion that his two-pin outlets shall be replaced by three-pin?—**REFLECTOR.**

Electric Vehicles

Consideration of "Battery Factor"

By T. C. Elliott

THERE has been some controversy about the lightweight, or so-called one-year, battery for electrically driven road vehicles, but no marked tendency to utilise it. One manufacturer has published a statement that he is beginning to employ thin-plate cells and although Continental practice has included the use of 300-cycle accumulators it is significant that in the same quarter the heavy-plate, or so-called three-year, battery is still in favour.

In both France and Germany, 1938-39 catalogues all listed four types of batteries for vehicles, namely, the pasted type (one year), "Panzer" type three years), Plante type (seven to eight years) and Edison alkaline type (ten years), with the first-named predominating, although all four types were in use.

The Société des Ingénieurs de l'Automobile had this subject under discussion at two conferences held in Paris in November, 1943, and May, 1944, which indicated the efforts that were being made to increase the output of electric vehicles. Notwithstanding the arduous conditions under which the French makers were working, and that in 1942 the Germans endeavoured to stop vehicle manufacture, a good measure of success was obtained. Up to the end of 1943 the number went up 600 per cent., whereas in Great Britain during the same period the increase in licensed electric vehicles was 52 per cent.

Some abstracts of the proceedings taken from the publications of the S.D.V.E. (Société pour le Développement des Véhicules Electriques) may be quoted, with the permission of the director, Mr. Maurice Bouchon, whose statistics and arguments rather favour the heavy type of battery. He holds that the electric vehicle must be established on a permanent basis and endeavours to demonstrate by actual results after twenty years' exploitation of electric vehicles by a company that they are not only practicable, but in certain applications they "will maintain a regularity of service that none would dare to expect from a petrol vehicle."

M. Bouchon insists that the electric vehicle must be used within its proper sphere and that electricity can be of good service in transport, but it cannot do everything. Financially, the electric vehicle consumes a low-priced fuel and, moreover, only when the motor is running. Strictly the battery should be classed as consumable energy and its amortisation should be added to the costs of electric power. The vehicle itself requires little upkeep, few repairs and a long period can be assigned for writing off the cost.

If the maximum profit is obtained from the inherent advantages of the motor, the contrary influence of the battery will be less noticeable. Applications must be so chosen as to minimise long journeys and in which maximum speed is only of secondary importance.

What may be called the "battery factor," all other things being equal (in particular life and price per kWh of capacity) represents the relationship between the weights of the battery and of the vehicle as well as their performances. In the following table four vehicles are compared under equivalent conditions on normal running tests. The route travelled by the vehicles was about ten

"BATTERY FACTOR," BASED ON RESULTS OF EQUIVALENT RUNNING TESTS OF FOUR VEHICLES, UNDER NORMAL OPERATION

Type of Vehicle	Type of Battery	CU (1)	PB (2)	PV (3)	PV+CU (4)	PT= PV+PB+CU (5)	km. (6)	Speed (7)	$\frac{CU \times km}{1,000}$ (8)	$\frac{PB}{\frac{CU \times km}{1,000}}$ (9)	$\frac{PB}{PV+CU}$ (10)
Lorry	Lead, heavy	6,000	2,535	4,000	10,000	12,535	59	18·8	354	7·15	0·25
Lorry	Lead, heavy	2,700	1,760	2,740	5,440	7,200	68	17·1	184	9·5	0·32
Van	Lead, heavy	880	880	1,220	2,100	2,980	68	18·2	60	14·6	0·42
Saloon, 2-seater	Lead, light-weight	75	550	525	600	1,150	98	31·7	7·35	75	0·92

(1) Pay-load in kg., not including driver. (2) Weight of battery, kg. (3) Total empty weight, including driver. This is similar to our taxing weight, *e.g.* exclusive of battery, but adds the weight of the driver. (4) Gross weight, less battery weight. (5) Gross weight. (6) Distance covered during tests, km. (7) Av. speed during test in km./h. (8) Ton-kilometres pay-load during test. (9) Weight of battery (kg.) per ton-kilometre of pay-load. (10) Weight of battery in relation to gross weight, less battery weight.

miles, including the steep rise to Sacré-Cœur de Montmartre *via* the rue Lanark, and repeated until the battery had discharged to 80 per cent. of its nominal capacity with the usual stops expected in service. The first three vehicles were of the industrial type, all made by the same manufacturer; the fourth was a private saloon car. The type of battery is according to the specification in U.S.E. Publication 79.

The penultimate column recording the weight of the battery per ton-km. of pay-load without any boosting charge is instructive as it indicates the influence of the battery on the net cost because in reality it is the merchandise carried that needs to be transported. It will be noticed, for instance, that the "battery factor" rises rapidly as the pay-load falls; in fact it is doubled if the effective load of the vehicle drops from six to one ton.

The saloon car shows a still greater variation in "battery factor" when compared with the 6-ton vehicle, but the purpose of a private car is different from that of a goods vehicle. To arrive at a comparison the "battery factor" can be considered as the weight (expressed in percentage) of a battery which must be applied to a loaded vehicle—that is to say, a displacement of useful load—in order to travel the required distance. This is shown in the last column, $\frac{PB}{PV + CU}$, which indicates that the "battery factor" of a saloon passenger car is twice that of a one-ton van, three times that of the 3-ton lorry, and four times that of the 6-ton class of vehicle.

This factor affords some indication of the type of battery most favourable for each case; that is, whether it should be of the heavy or lightweight type. If the proper allowance is made for the shorter life of the lighter pattern, its net cost will work out at eight times more than on a 6-ton industrial vehicle and four times more than on a 1-ton electric van.

These figures are not intended to be absolute, but clearly show that it is in the carriage of goods for suburban and local delivery that the most economical results are obtained and that the larger the vehicle the better will be the results financially and technically.

North of Scotland Board

First Report Published

THE first report of the North of Scotland Hydro-Electric Board just published (price 6d.) covers the period from September, 1943, to December last. It records the setting up of the Board; the preparation of the Development, Constructional and Distribution Schemes required by the Act under which the Board was constituted; and the obtaining of information on such matters as rainfall, river flow and geological formation.

The report states that the first Constructional Scheme (Loch Sloy, Loch Morar and Lochalsh projects) into which an inquiry was held has now been confirmed and became operative on March 28th last.

Future Policy

With regard to the Board's future policy, the report says that surveys of schemes both large and small have been pressed forward as rapidly as possible and they are continuing. Schemes to supply ordinary consumers appear without exception to be uneconomic; in the aggregate the annual loss will be very large and it will have to be covered by profits earned in other directions. Schemes to supply authorised undertakings and large power users will be published during the present year, but supplies to these are not expected to yield much profit as they must be cheap to be attractive. Consequently projects of the same exporting type as the Loch Sloy Scheme are required and are being prepared, which will help to pay for the many uneconomic distribution schemes and to finance a "grid" in the North of Scotland District.

For the present the Board's financial requirements are being met by temporary borrowing from the Scottish banks. Up to the end of 1944 the total expenditure amounted to £136,846; this was incurred on surveys, the preparation of schemes and other preliminary and administrative expenses and interest on borrowed money. Interest on the capital cost of works is a large element in the total cost of hydro-electric schemes and in order to reduce it to a minimum application is to be made to the Treasury for a guarantee in accordance with the Act. The Board emphasises, however, that while such a guarantee will reduce the annual charges it is not a grant and the Board must pay its way.

Prototype Houses

THE House-Building Industries Standing Committee, an organisation sponsored by the National Federation of Registered House-Builders, and supported by trade associations connected with the building industry, is preparing for the erection by competition of a number of prototype houses in England and Wales. The houses will provide a "testing ground" for new ideas. The Committee is prepared to consider any suggestions for the introduction of new fittings and equipment. Firms and individuals who believe that they can contribute sound and practical improvements to post-war housing are invited to send concise particulars for consideration and possible incorporation in the houses now being planned. In the first instance, brief details should be sent in writing to the Organising Secretary, House-Building Industries Standing Committee, 82, New Cavendish Street, London, W.1.

Meter Jewels and Pivots

Results of Life Tests

WITH the object of obtaining more fundamental knowledge about the phenomena associated with watt-hour meters and other instrument bearings with a view to their improvement, research has been proceeding for a number of years in the meter testing laboratories of the Northmet Power Co. on behalf of the British Electrical and Allied Industries Research Association.

Various aspects of these extensive investigations are briefly outlined in a paper by Mr. G. F. SHOTTER (Northmet Co.) submitted to the Measurements Section of the Institution of Electrical Engineers last week. The paper is a précis of some of the salient features of the second interim E.R.A. report (ref. T/T.39) on the subject and deals mainly with the sapphire/steel combination of jewel and pivot, both dry and lubricated, but also discusses other combinations of materials.

Scope of Investigation

Test methods and apparatus are described, followed by a survey of the results of life tests, including an analysis of the several factors which contribute to wear and discussion of the microscopical examination of the specimens tested at the end of their life run. A theory of the boundary lubrication existing in such bearings is briefly stated with a short extract from the detailed discussion of the various factors disclosed in E.R.A. reports (T/T.31 and T/T.39), while the mathematical formulæ developed during the research are simplified into nomograms.

The results of experimental determination of the resistance of sapphire jewels to impact forces are stated and phenomena associated with bottom bearings at various loads, caused by parasitic forces existing in meters, are also discussed. The actions of bearings of both the ball and pivot types are compared and an approximate estimation, based on life tests, has been made of the life of bearings in practice.

There is no doubt that there is a definite limit to the weight that can be carried on a steel/sapphire bearing and one of the outstanding facts revealed by these experiments is the extraordinary effect of specially refined Pennsylvanian "meter oil No. 2" on the extension of bearing life. Medicinal paraffin is practically devoid of lubricating value because it is too highly refined; its use can increase friction above dry running values.

In these experiments the "life of a bearing" has been determined by the permissible increase of friction. The latter generally increases rapidly at first until it reaches a stabilisation period; then, although generally showing an upward trend, the rate of increase will be considerably less. When the bearing is reaching the end of its useful life a more rapid rate of increase of friction generally occurs which, particularly in dry specimens, can become high and variable. When lubricated with a sufficient quantity of suitable oil the rate of increase of friction at the end of life is considerably smaller and will probably never reach the value attained by dry specimens.

Taking the film-rupturing stress of mineral oil as about 2·2 tons/in.^{2} it has been argued in the past that a film cannot exist under pressures upward of 50 tons/in.^{2}, but such criticism has not taken into account boundary lubrication, the occurrence of which has been confirmed by this research.

Friction between smooth surfaces is caused by the unbalanced forces of molecular attraction of the surfaces acting across the interface; the function of a lubricant is to neutralise those unbalanced forces. When the surfaces are separated by a layer of lubricant that is thick enough to place the plane of slip beyond the influence of the enclosing solids, the frictional resistance is due solely to the internal friction (viscosity) of the lubricant, which is of the "fluid" type or complete. But when the slippery film is so thin that every part of it is within, and has its properties modified by, the strong attraction forces of the solid surfaces, then the frictional resistance of the surface of slip is due mainly to those attraction forces and the lubrication is of the "boundary" type or incomplete.

The ratios between the average "life revolutions" of unlubricated specimens under a weight of 17 g with jewels cut so that their optical axes are at 0, 45, 62 and 90 degrees to the pivot are respectively 1·15 to 1 to 1·8 to 540. The reasons for the observed variation of the rate of wear with angle can only be sought in the crystalline structure of the sapphire, it being softer in the direction of the optical axis and harder at right angles to it. Such difference of hardness is not confined to the sapphire Surface cracks and shaling within the wear area will produce excessive friction; this kind of breakdown is to be least expected in 90 degree jewels.

Discussion

MR. E. FAWSSETT (North Eastern Electric Supply Co.), in opening the discussion, said that as chairman of the Committee of the E.R.A. concerned he would not criticise, but would detail some aspects which he had not felt able to dispose of entirely. The

speed at which the tests were made (280 RPM) was no doubt adopted to save time, but it was very different from the actual speed of an ordinary meter which varied from 0 to 50 RPM. There was justification for the author's conclusion that ball bearings " if in perfect order to start with " should last very much longer than the pivot type " in present designs." The paper clearly indicated that it was not wise to over-run a meter of the present conventional design or contemplate a considerably larger full load torque from such a meter, though it must be remembered that the number of hours in a year during which the meter was operating at high loads was usually very small. Much more serious, probably, was the statement—which ought to have been in italics or capitals—that " a normal meter has no-load wear equivalent to 157 million revolutions per annum." If the author could combine the effect of this with the load tracking, and apply it to a typical meter load programme over the year, he should get an extremely interesting answer, not too comforting to the meter engineer and likely to reduce the term usually thought satisfactory for a meter to remain out on service. Other oils than those mentioned in the paper had been developed with similar properties as regarded dispersion, stability, etc., and with a flatter viscosity curve and he had heard it said that they gave better results in a cold climate.

DR. D. CLAYTON wondered whether oils from other sources than Pennsylvania would not be equally satisfactory. He did not think this particular job called for anything special in the way of the source of the lubricant. Also, the author was a little too strong in his statement that medicinal paraffin was practically devoid of lubricating value as evidence existed that for clean steel surfaces the friction could be reduced one-third by the use of such an oil. He was surprised at the statement that Pennsylvania oil was the only one that would maintain a film under high pressure.

Supply of Jewels

MR. L. J. MATTHEWS (Electrical Apparatus Co., Ltd.) said that while the paper was not controversial because it contained the results of research, he would like to know to what extent the tests approximated to service conditions. He said it was of the utmost importance to instrument and meter makers and users that, at the earliest possible moment, free access should be available once more to all sources of supply of jewels.

MR. P. GROZINSKI (Diamond Research Department) said it was not clear whether other jewels than sapphire had been experimented with, particularly in respect of orientation. While it was suggested in the paper that the sapphire was " softer " in the direction of the optic axis and " harder " at right angles to it, that was opposite to findings by other workers in this field.

MR. L. B. S. GOLDS (Edmundsons Electricity Corporation) remarked that the results could be applied to many other types of apparatus. It was due to Mr. Shotter's enthusiasm that this work started and continued for so many years. The paper indicated how unwise it would be to attempt to standardise meter design at the present stage of development and it was also important not to jump to conclusions. He hoped that Mr. Shotter would continue his fundamental analysis of other parts of the meter, such as the top bearing. Having had some eighteen years' experience of the ball bearing, he had found that it gave as good results as, if not slightly better than, the pivot bearing and, strangely enough, the ball bearing had been run so-called dry. Actually that was not so because a certain amount of oil was always present on the surface, even of jewels. Therefore it seemed that if the ball bearing were properly oiled with the right type of oil it might be actually better than the jewel.

Developments in Oil Refining

DR. N. L. ANFILOGOFF (Texas Oil Co.) stated that since this work was started nine years ago a great number of changes had taken place in the refining of oils and it did not follow now that Pennsylvania No. 1 oil would give the best results. Moreover there was no reason to think that a less, or more, viscous oil would give better lubrication.

MR. H. COBDEN TURNER (Salford Instruments) expressed the view that the instrument bearing was a much greater problem than the meter bearing. Meters were recalibrated periodically and it was easy to put in a new jewel, but an instrument might go throughout its life with the same bearing. He thought the diamond would be better than the sapphire, because it was the hardest jewel known.

MR. G. E. MOORE (Sunderland Electricity Department) asked if there was any intention of investigating whether jewels should be sprung or not. He also suggested that the jewel should be cemented into the mount otherwise a certain amount of oil was bound to seep away in the interstices between the mount and the jewel. Again, would the author recommend that the jewel should be more deeply sunk into the mount so that a fair amount of oil could be put into the well and if a meter was laid on its side a certain amount of oil would always be retained on the inside walls of the well.

MR. L. C. MASKELL (Silvertown Lubricants) said that while he had been responsible with others, for developing the oil used by Mr. Shotter, there appeared to be no reason why other oils should not be equally satis-

factory. However, up to date, Mr. Shotter had not been able to find one which gave exactly the same result as Pennsylvanian No. 2.

MR. SHOTTER, in the course of a brief reply, said that he thought the results showed there was a decreased coefficient of friction with the oil that was used. The paper did not suggest that the sapphire was "softer" than the diamond in the direction of the optic axis. He had never claimed that there was no oil in existence as good as Pennsylvania No. 2, but it was necessary to start somewhere. He did not agree that the instrument was a more difficult problem than the meter from the point of view of bearings; certainly he had never seen an instrument which went through its life with the same jewel. He agreed that a spring would help the jewel, but some makers, when they put in a spring, used one strong enough to hang the meter on! The best way of keeping the oil in the bearing and preventing damage during transport was to lift the disc off the jewel, but it cost a little money to do that and the makers did not like it.

Fuses and Relays

Excess-Current Protection in Medium-Voltage Circuits

IN opening the discussion on the two papers by Messrs. R. T. LYTHALL, A. G. SHREEVE and P. J. SHIPTON (*Electrical Review*, May 4th) before the Installations Section of the Institution of Electrical Engineers, MR. H. W. SWANN emphasised the statement that the problem of providing excess-current protection in medium-voltage circuits could be solved by co-operation between user and manufacturer. The earth fault striker described by Mr. Lythall was a welcome innovation. When the occupier of a large factory with an installation that had been in for many years was faced with the installation of earth-leakage protection or indication on a large scale, it might present considerable financial problems and usually meant a compromise arrangement, which was never really satisfactory. The fact that the earth fault striker carried with it the additional advantage of being a protection against single phasing on local circuits was all to the good because the latter led to burn-outs which resulted in fires.

Education of the User

The theme of both papers was the need for studying and tackling this problem from a strictly technical angle and he emphasised the unbridged gap there was between engineers and a considerable section of people who used these products. He was thinking of the small one-man contractor and the single-handed electrician in works who was sometimes just a "handy" man. This problem was important ten years ago and in ten years time it would be far more important when the load demanded might be ten times what it was now. Hence the importance of ensuring an intelligent selection on the basis of the requirements. What could be done to get the facts over to a larger and more directly affected body of people than were represented at that meeting?

MR. H. E. COX (B.T.H. Co.) remarked that although the h.r.c. fuse had already carved a place for itself, it suffered from certain disadvantages. The question was whether those new devices became a member of an already existing family, with complementary functions; did they increase the usefulness of an already existing family, or did they displace existing members because they could do the job better and more economically? It was possible to determine average characteristics for types of motors and make relays to match. He hoped eventually it would be possible to solve the problem along those lines.

Marking Fuses

MR. L. H. WELCH (Central London Electricity) suggested that each fuse manufacturer should use a distinctive number or letter so that the user would know what it meant. At the present time there were so many fuses and so many boxes in use that the expense of changing to a standardised type was too great for the theoretical considerations set out in the paper to be applied. If the job was best done by a circuit breaker, then it should be employed and not a hybrid affair of a fuse with a circuit breaker. He appreciated that economically at present that was not possible. He favoured earth fault indicators, but was against earth fault trips.

MR. J. W. GIBSON (General Electric Co.) said that the single-phasing solution put forward by Messrs. Shreeve and Shipton was much less complicated than that of Mr. Lythall. Remarking that many people were afraid to take advantage of the benefit to be obtained from the use of h.r.c. fuses, he said he was pleased with the manner in which Mr. Lythall had put the matter over. On the question of selection, he agreed that design conditions should be brought into consideration and said that too often the designer heard nothing more about his design except when there was trouble. For slip-ring motors he suggested a larger fuse should be put in than was recommended by Mr. Lythall, but a 60-A fuse for a 1·5-HP

motor, as indicated in one of the illustrations, was too large. He did not think the 6 per cent. tolerance recommended by Mr. Lythall on fuses in service was high enough and suggested that the correct figure was somewhere between that and the 33 per cent. given in the other paper.

MR. S. J. R. ALLWOOD (L.M.S.), speaking as a user of h.r.c. fuses, said there could be no disagreement on the principle of using h.r.c. fuses for fault protection of equipment and leaving the overload protection to the switchgear, but there was a need for a satisfactory overload relay. It was important that the fuse should maintain its rated fusing and clearing time. There were various factors which affected this, such as fuse temperature, the nature of the load and the quenching powder with which the fuse was filled. This latter was most important for he recently had a case in which a fuse, filled with the wrong grain of powder, performed in a most unsatisfactory manner. The physical dimensions of the fuse and its associated mountings should receive careful consideration, as on several occasions he had experienced severe flashovers between the caps of the fuses.

Co-operation Needed

MR. J. COLLINS (English Electric Co.) said the popularity of the standard h.r.c. fuse was the simplicity of the equipment with which it was used, but he wondered whether the advantages claimed for equipment incorporating the tripping type of contacts would make up for the very considerable elaboration of switchgear necessary if the advantages of the tripping fuse were to be fully utilised. The whole question of motor protection was tied up with the heating caused by the excess current, and it would be better to use this heating to operate some sort of relay rather than use the current itself. In other words, he was pleading for co-operation between the control gear manufacturer and the motor manufacturer, for the incorporation of a thermal type of relay in the motor windings on the lines suggested by the authors of the second paper. Then it would be possible to use a simple type of switch fuse and a simple type of fuse board; these were the lines on which development should take place.

MR. H. W. M. PARKER (Brookhirst Switchgear) said the fuse had many advantages which were not always appreciated and the circuit breaker could be used in a different field in many cases. The h.r.c. fuse could protect cables against sudden shocks and had a considerable advantage over the circuit breaker. In boiler-house equipment single-phasing protection was particularly necessary.

MR. J. R. TAYLOR also stressed the importance of co-operation between the manufacturer and user. The control gear maker should be told what the motor was going to drive because the starter was there more for starting the machine than starting the motor.

MR. F. C. FUKE said Mr. Lythall rather implied that there was strict interchangeability between fuses, and asked if that were so.

MR. N. N. HUMPHREYS called attention to the fact that no mention was made in Mr. Lythall's paper of the ambient temperature in which the fuses were installed. A fuse might be installed in a cold place or in a boiler house and it was advisable to ask the fuse maker what effect this would have on the fusing curve. With regard to the second paper, he said it was about time that somebody spoke up in public and exposed the inconsistencies of the specifications.

MR. J. SOLOMON said that in regard to earth fault protection it was necessary to educate users as to the limits of the cartridge fuse in relation to earth faults.

MR. LYTHALL, in a brief reply, said it seemed to him that two if not three major points had emerged from the discussion. The first was the need for some additional education effort among the users of fuses to enable them to study, on the lines suggested in his paper, the correct selection of the fuses they were going to use. That was probably the most difficult of the problems. Then there was co-operation between manufacturer and user and he believed that the correct answer to the correct fuse selection—or the biggest part of the answer—lay in the user giving the manufacturer much more information than usual about the circuit on which the apparatus was to be used. Then there was the point as to whether these new developments were part of an existing family or did they form a new family. The new fuses fell into the category of a new family.

MR. SHREEVE, in his reply, said trouble was found most frequently when the problem was not handled by a professional electrical engineer or where there had not been co-operation between the various manufacturers. Generally, the trouble was due to the manufacturer not obtaining the necessary information from the user. As regards education, if equipment based on British Standard specifications was to be used, there must be education of the user; without that, he did not see how mechanical or non-electrical engineers could select apparatus.

Fatality

While hanging clothes on a wire line Able Seaman Edward Smith received a fatal electric shock. At the inquest at Sheerness it was stated that there was an aerial leading to the post to which the clothes line was attached and the end of the aerial had come in contact with the line. At the radio set the bare end of the aerial wire was free. A voltage of 260 was measured between the radio chassis and earth.

ELECTRICITY SUPPLY

Increased Costs at Leeds. Rebuilding Bankside Station.

Bolton.—LOAN FOR POWER STATION EXTENSIONS.—The Electricity Committee is seeking sanction to borrow £655,373 for power station extensions and £9,050 for coal-handling plant.

Hull.—LOANS.—The Electricity Committee is seeking sanction to borrow £28,685 for mains, £1,050 for substations and £17,081 for substation equipment.

Leeds.—INCREASED COSTS.—Speaking at last week's meeting of the City Council the chairman of the Electricity Committee (Councillor C. A. Goodall) said that the latest increase of 3s. 6d. a ton in the price of coal as from May 1st meant an additional expenditure of £70,000 a year to the Electricity Department. Moreover, wage increases for several sections of employees came into force this month. It would be clear, therefore that the Department's estimates had been absolutely "cut to ribbons."

LOANS FOR PLANT EXTENSIONS.—The Electricity Commissioners have sanctioned the borrowing of £100,000 for civil engineering works and £800,000 for generating plant in connection with the Kirkstall generating station extensions.

London.—REBUILDING BANKSIDE STATION.—Southwark Works Committee is objecting to the proposal of the City of London Electric Lighting Co., Ltd., to rebuild its Bankside power station because it will prejudice any scheme for the redevelopment of the south bank of the Thames. Plans indicate that the new power station will be a building with two chimneys, somewhat on the lines of the Battersea power station.

METERS.—Southwark Borough Council Electricity Committee proposes to purchase from the Poplar Electricity Department up to 1,500 DC 20-A prepayment meters at 30s. each and to convert them from 1d. coin to 1s. coin calibre at an estimated average cost of 10s. per meter.

Manchester.—MODERNISATION OF STREET LIGHTING.—A special street lighting committee appointed to consider the question of modernising the city street lighting has invited the Electricity and Gas Committees to prepare memoranda indicating their views on certain aspects of the matter.

Norfolk.—SUPPLY TO VILLAGES.—In the House of Commons last week Mr. De Chair asked the Minister of Fuel and Power whether he was aware that 46 villages in the South-west Norfolk Parliamentary Division were without an electricity supply at present and that only 37 of those were provided for in the post-war development schemes of the East Anglian Electric Supply Co.; and would he institute an immediate inquiry into the position of electricity supplies in South-west Norfolk with a view to supplying all these 46 villages with electricity in the shortest possible time.

Major Lloyd George said that it had been necessary during the war to restrict electricity development because of the shortages of manpower and material. Such restrictions could not yet be relaxed. The post-war development schemes of the East Anglian Electric Supply Co. would result in supplies being available in 85 of 94 villages and hamlets in that part of South-west Norfolk which was in the area of supply of that company. Limited supplies were already being given in most of the remaining nine places. In view of these facts he did not consider it necessary to institute any inquiry.

Salford.—LOANS.—The Light, Heat and Power Committee is seeking sanction to borrow £4,000 for meters and £10,000 for substations.

Worcester.—CABLE-LAYING.—It is proposed to apply for a loan of £33,000 for cables and ancillary work in connection with the bulk supply to Malvern.

London J.E.A.

AT last week's meeting of the London & Home Counties Joint Electricity Authority the following matters were reported:—

West Ham Power Station Extension

The Technical Committee had received from the West Ham Corporation a copy of an application which had been made to the Electricity Commissioners for consent to the extension of the Corporation's generating station by the installation of a 60,000-kW turbo-alternator, with the necessary boiler and auxiliary plant, switchgear, buildings and land at an estimated cost of £2,428,455. The Committee observed that the capital cost represented £40·5 per kW installed. On present prices the cost would amount to £32 per kW when the whole extension, totalling £180,000 kW, was completed.

New Transmission Cables

An application to the Commissioners by the Metropolitan Electric Supply Co., Ltd., for consent to lay 25,000-V transmission cables was reported. The company stated that these cables (from Uxbridge substation to Hayes substation at a cost of £65,800 and from Hayes substation to Staines substation at a cost of £68,875) were required to deal with increases of load in the Hayes, Staines and Sunbury Cross areas. The Technical Committee of the Authority stated that it had given instructions for certain questions to be raised with the Commissioners.

Metropolitan Company's Charges

The General Purposes Committee reported that representations were made earlier in the year by the Ealing, Heston and Isleworth, and Maidenhead Corporations with regard to an application by the Metropolitan Electric Supply Co. to the Electricity Commissioners for a direction under Section 3 (2) of the Electricity (Supply) Act, 1935 (this section relates to the computation of prices for indirect bulk supply).

An inquiry was held in March and as a result the Commissioners decided that in all the circumstances it did not appear to be in the general interest to give the direction applied for and they therefore proposed to give no direction.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Brush Electrical Engineering Co., Ltd.—Speaking at the company's annual meeting last week, Sir Ronald Matthews (chairman) explained why the trading profit had been reduced in spite of an increased turnover. First, careful consideration had been given to the re-design of one of the company's main products, in consequence of which manufacturers' stock work in progress, which had been produced to old designs, had been valued bearing this in mind. Secondly, the factory of one of the subsidiary companies had been removed to Loughborough and its trading position had thus been adversely affected. Thirdly, there had been variation in demands for their war products, a dislocation which had caused fluctuations in turnover with consequent effect on profits and on the valuation of stocks and work in progress.

Sir Ronald referred to the company's South African subsidiary, Brush (South Africa) (Proprietary), Ltd., which started trading in Johannesburg in January, 1944, and in which the company owned more than half of the issued capital. This company would have a deficiency on its first year's working, but provision had been made for this. During the year Petters, Ltd., with certain other oil engine companies, had formed British Oil Engines (Export), Ltd., to offer to the export market a comprehensive range of engines. Practically the whole of the considerably increased engine turnover had been taken by the Ministries of Aircraft Production and Supply, first for use in the European zone and latterly for the S.E.A.C. Since the beginning of the war the company had been producing gun mountings for tanks and the whole of the resources of the coachwork division had been concentrated on war supplies, including general service vehicles and radiolocation cabins. Other work had been the repair of aircraft fuselages and the production of complete wooden aircraft. Steps were being taken to see that during the transitional period from war to peace, dislocation of production was reduced as far as possible. The company had an advantage in this respect inasmuch as many of its normal products, with slight modifications, had been used for war purposes. In conclusion the chairman referred to the company's apprentice training programme and educational work.

British Electric Resistance Co., Ltd.—The company's adjourned ordinary general meeting was held last week, Mr. H. Paul-Huhne presiding. In a statement which had been circulated the chairman explained that the delay in the presentation of the accounts was due to the fact that the directors considered it desirable to obtain price agreements on contracts executed during the year, and also to the effect of the constantly increasing volume of work undertaken. He pointed out that the trading profit had doubled, but after taxation the profits available for distribution did not vary substantially from those of the previous year. The company had increased the sales of its products within the Empire; this applied particularly to the heavy transformers manufactured by their subsidiary company, the British Power Transformer Co., Ltd. Extensive research work had been undertaken and the results were being incorporated in their post-war designs. He stated that the directors had under consideration the acquisition of additional premises.

Johnson & Phillips, Ltd., report that the gross profit for 1944, after charging £66,000 (£62,000) for maintenance of buildings, plant, etc., was £458,402, compared with £510,224 for the preceding year. The amount provided for taxation is £100,000 lower at £180,000, and after meeting various charges, including £20,698 (£10,406) A.R.P. expenditure written off, the net profit is £180,325 (£139,873). A sum of £25,000 (£15,000) is transferred to research and development account and £80,000 (£30,000) to special reserve for contingencies. The final ordinary dividend is again 7½ per cent., making 15 per cent. for the year, and £108,340 is carried forward (against £93,015 brought in after deducting £23,226 bonus to staff and workpeople for 1943).

Veritys, Ltd.—It is reported that negotiations with the Admiralty regarding price fixing are not sufficiently advanced yet to enable the directors to submit accounts. The accounts for 1944 are in draft, and it is hoped that it will be possible to publish both the 1943 and 1944 accounts about July next. The directors do not propose to recommend any further dividend in respect of 1943 and are satisfied that the profits justify an interim dividend of 7½ per cent. for 1944.

Heatrae, Ltd.—The accounts for the year ended February 28th show a net profit of £15,192 (against £11,312 for the preceding year). Allocations include £1,000 for deferred repairs, £2,000 for general reserve and £4,310 for reducing the book value of property, plant and machinery. The ordinary dividend is again 12½ per cent. and £7,500 (£7,368) is carried forward.

The West London & Provincial Electric & General Trust, Ltd., proposes to pay a final dividend of 4 per cent. on the ordinary stock, making 6 per cent. (same) for the year ended March 31st. The net profit was £12,836 (against £12,383).

The Rawlplug, Co. Ltd., recommends a final dividend of 30 per cent. on the ordinary shares, making 40 per cent. as before. The net profit for 1944 amounted to £65,830 (against £65,314).

Altrincham Electric Supply, Ltd., is paying a final dividend of 4s. 4·19d. on its deferred shares.

Pinchin, Johnson & Co., Ltd., report a net profit for 1944 of £526,661 (against £573,237) to which are added £173,343 (£169,202) brought in and £60,000 (nil) transferred from contingencies reserve. By a change of accounting practice £180,000 (nil) is provided for income tax in respect of 1944 as well as £238,379 (£189,479) for 1943 and £180,000 (£200,000) for E.P.T. The ordinary dividend is main-

tained at 10 per cent. by a final payment of 7½ per cent. and £43,526 is carried forward free of any tax liability.

The directors state that the decrease in the net profit is due to a drop in dividends from subsidiary companies and to an increased proportion of direct sales to Government Departments.

The Ever Ready Trust Co., Ltd., held its annual meeting last week, Mr. Magnus Goodfellow presiding. The chairman, in a statement circulated with the report and accounts, while admitting the possibility that over a short period values might show some decrease, anticipated that producers, manufacturers and traders of this country, given some relief from the enormous burden of taxation, the minimum of Government interference, and such help as the Government might be able to contribute, would ensure quite quickly a flourishing post-war condition in our industries.

Allen West & Co., Ltd., record a trading profit, after taxation, amounting to £102,281 for the year ended January 31st last, the previous year's figure being £97,294. Dividends £5,757 (same) increase the totals to £108,038 and £103,051 respectively. After providing for debenture interest £8,838 (£9,080), directors' fees £3,000 (same), depreciation £15,000 (same), war risks £6,418 (£11,747), deferred repairs £10,000 (nil), debenture redemption sinking fund £4,585 (£4,350) and buildings reserve £10,000 (same), the net profit is £50,197 (£49,874). General reserve again receives £15,000 and the dividend is maintained at 7½ per cent., leaving £60,738 (£62,104) to be carried forward.

John Shaw & Sons, Wolverhampton, Ltd., announce that a further sale of redundant land by their subsidiary, T. E. Thomson & Co., Calcutta, has recently been made at a substantial profit, increasing the capital reserve to £50,000, which has been declared as a capital bonus and transferred to the John Shaw capital reserve. When conditions permit it is proposed to form a new subsidiary with the name of John Shaw to continue the merchanting business and to change the present company's name to one more indicative of the business as a whole.

The Marconi International Marine Communication Co., Ltd., has announced a final dividend of 5 per cent., again making 7½ per cent. for the year. The net profit was £90,138 (against £93,392).

Babcock & Wilcox, Ltd., propose to pay a final ordinary dividend of 6 per cent., plus a cash bonus of 2 per cent., making 12 per cent. (against 11 per cent.) for the year.

Ransomes & Rapier, Ltd., recommend a final dividend of 4 per cent., again making 6 per cent. for the year. The net profit was £29,603 (£25,186).

The Metropolitan Electric Cable Construction Co., Ltd., has increased its final dividend from 5 per cent. to 10 per cent., making 15 per cent. for the year (7½ per cent.).

Ransomes, Sims & Jefferies, Ltd., recommend a first and final ordinary dividend of 7½ per cent. (same).

The British Vacuum Cleaner & Engineering Co., Ltd., has announced an interim dividend of 12½ per cent. (same).

New Companies

S. Goodchild, Ltd.—Private company. Registered March 20th. Capital, £2,000. Objects: To carry on the business of electrical, radio, mechanical and general engineers, etc. Directors: Stanley J. Goodchild, and Mrs. Ivy F. Goodchild, both of Journey's End, London Road, Brentwood. Registered office: 36, High Street, Brentwood, Essex.

Shipley Fan Co., Ltd.—Private company. Registered April 17th. Capital, £7,000. Objects: To acquire the business of fan manufacturers and merchants carried on by H. Summersgill and W. Keighley at Valley Road, Shipley, as the Shipley Fan Co. First directors: H. Summersgill, 1056, Bolton Road, Bradford, and three others. Registered office: Valley Works, Valley Road, Shipley.

Parkers (Electrical Supplies), Ltd.—Private company. Registered April 30th. Capital, £1,000. Objects: To acquire the business of a dealer in electrical appliances carried on by John Parker at 24, Sadler Gate, Derby. Directors: J. Parker and Mrs. Amelia Parker, both of 50, Birchwood Avenue, Littleover, Derby. Registered office: 24, Sadler Gate, Derby.

A. S. Duran & Co., Ltd.—Private company. Registered April 26th. Capital, £2,000. Objects: To carry on the business of manufacturers of, wholesalers and dealers in radio sets, gramophones, electrical components and accessories, etc. Directors: A. S. Duran and Juanita E. Duran, both of Thatched Cottage, Twyford, Berks. Registered office: 58a, King's Road, Reading.

James Wright (Mayfair), Ltd.—Private company. Registered April 24th. Capital, £200. Objects: To carry on the business of electrical engineers and contractors, etc. Directors: F. J. A. Wright, 8, Dorset Chambers, Chagford Street, N.W.1, and A. Upton, 55, Amesbury Road, Hanworth, Middlesex. Registered office: 15, Davies Street, W.1.

Company to be Struck off Register

Unless cause is shown to the contrary the Blockley Electrical Engineering Co., Ltd., is to be struck off the Register at the expiration of three months from April 27th.

Liquidations

Western Battery & Maintenance Co., Ltd., 57-58, Finsbury Court, Finsbury Pavement, London, E.C.—Liquidator, Mr. H. P. Naunton, Senior Official Receiver and Liquidator, Columbia House, Aldwych, London, W.C.2, released April 30th.

Electrical Utilities, Ltd.—Last day for receiving proofs for dividend, May 15th. Liquidator, Mr. C. L. Walker, 10-11, Park Place, St. James's Street, S.W.1.

Bankruptcies

G. S. Whiston, electrical engineer, 112, West Street, Crewe. — Supplemental dividend of 1s. 3½d. in £, payable May 14th, at the Official Receiver's Office, 12, Lonsdale Street, Stoke-upon-Trent.

STOCKS AND SHARES

TUESDAY EVENING.

PRICES of stocks and shares in most of the markets pursue an even course in spite of the excitements which have attended this present month of May. Uncertainty and suspense, which at all times serve as a severe handicap upon activity in the House, have played their usual part this time in the contraction of the volume of orders, and in inducing a slightly reactionary tendency. The majority of price-movements are, however, still in favour of holders of shares, and the strength shown by preference issues is worthy of notice as an indication of the attitude of investment towards the outlook.

Electricity Supply

Buyers come along, with hardly a halt, for the ordinary shares of the home electricity supply companies. Metropolitans are 45s., London Electrics 32s. and City Lights 31s. 6d. Southern Areas hardened to 24s. All the rises of a week ago have been retained: the advance in the price of coal failed to stem the intentions of share buyers. In the foreign section, Cawnpores keep their gain at 48s., acquisition hopes continuing optimistic. The feature in this group is a rise to 16s. 6d. in Perak Hydro Electrics. The successes against the Japanese encourage hopes of the company being restored to its rightful owners, Singapore Traction preference are 1s. 6d. higher at a guinea.

The Rise in Prices

A fresh jump in Oriental Telephones carried the price to 59s. 6d. which is 8s. up in less than three weeks. Improvements of 3d. or 6d. made Veritys 9s., Revo 44s., Laurence Scott 14s. 6d., Burco 16s. 3d. Switchgear & Cowans, the price of which rarely moves, are $\frac{1}{16}$ higher at 22s. Amongst the "heavy" shares, Babcock & Wilcox at 56s. 6d. have responded to an increase of 1 per cent., to 12 per cent., in the dividend. British Electric Traction deferred is 20 points to the good at 1235. London Passenger Transport "C" rose to 66½, the 'bus and tram strike having no effect on the price. British Insulated eased off to 6$\frac{15}{16}$. The 5½ per cent. "A" preference are harder at 29s. Great Northern Telegraphs are £2 up at 30. Rises of 6d. carried Callender's 6½ per cent. preference to 35s. and the 7½ per cent. "B" preference to 38s.

Radio Shares

The radio market is steady, without showing any great change. E.M.I. shares have revolved around 35s. 3d. and at that price are 9d. down on the week. Cossor at 33s. 6d. have also lost 9d. and Philco at 15s. are 3d. lower. Last week's gains were sharp and led to profit-snatching.

Enfield Cable Works

Enfield Cable ordinary shares have risen 2s. 6d. to 68s. a comparatively modest inquiry coming upon a market in which the supply of shares is limited. A fortnight ago, the price went ex the final dividend of 6¼ per cent., making 12½ per cent. for the year. At the current quotation, the yield on the money is £3 13s. 6d. per cent., which seems modest enough regarded merely from the point of view of present return. In 1938 and 1939 the dividends were 16¼ per cent. Capital bonuses were distributed in respect of 1935 and 1937. The chairman's recent statement referred to the 132,000-V underground compression cable, the first of its kind in the world, which the company has developed. The board believes that this type of cable has a great future.

Brush Electrical

Brush Electrical Engineering shares are quoted ex dividend, the price remaining without alteration at 11s. At the company's meeting last week the chairman dealt with the period of change-over from a war to peace basis. He forecast a heavy demand in the post-war years for the company's engines, public transport vehicles, power plant and other products. Much of what he said will apply to other companies engaged in similar branches of industry.

Johnson & Phillips

Johnson & Phillips are making up their dividend for the year to 15 per cent. as before, the fall in the trading profits of £51,800 being offset to some extent by the reduction for tax provision. This reduction, with other movements, left the net profit at £180,000, being £40,500 up on the year. At to-day's price of 76s. 6d. the shares give a return of £3 18s. 5d. per cent. on the money. Johnson & Phillips ordinary take rank amongst sound industrial investments.

Ever Ready

Ever Ready (G.B.) will issue its report and accounts on May 11th, the net profit of £589,000 showing a decrease of about £33,000 as compared with the previous year. The profits, for the past year ended March 31st, are sufficient amply to cover the dividend which again makes 40 per cent. for the full year, the rate paid annually since 1940 inclusive. For the four years, 1940-1943, 5 per cent. of the 40 per cent. was declared as bonus, but in each of the past two years the full amount was regarded as dividend. The shares stand at 45s. 3d. which may be compared with the 16s. 3d. to which the price fell in the year of the French collapse, 1940. The yield is 4½ per cent. allowing for the dividend included in the price. This is not a bad return, as yields go nowadays.

Advice to Contractors

Effects of Wartime Legislation

THE Director and Secretary of the Electrical Contractors' Association (Mr. L. C. Penwill) has informed his members that the Board of Trade has issued a General Licence (S.R. & O. 1945 No. 245) under the Location of Retail Businesses Order, which permits building and civil engineering undertakings, as defined in Defence Regulation 56AB, to supply at any premises such articles of ironmongery and such electrical goods (other than radio goods, electric torches and torch batteries) as are used in the course of building and civil engineering contracts, without obtaining individual licences. He says that it appears to be desirable to give an up-to-date review of wartime legislation as it affects electrical contractors and retailers.

Licences and Certificates of Registration

Where a trader comes within the scope of the Location of Retail Businesses Order, a licence is necessary in respect of each place from which such trade was *not* carried on during the "basic period," December 1st, 1940, to October 23rd, 1941. Certificates of registration under Defence Regulation 56AB must be held by all undertakings carrying out registrable work, irrespective of when that type of work was commenced, but only one certificate is necessary for each undertaking.

Electrical contractors exclusively engaged upon work within the scope of Regulation 56AB and who come within the definitions "Building undertaking" or "Civil Engineering contracting undertaking" must hold a certificate of registration from the Ministry of Works. Electrical contractors who, coupled with the work described above, undertake work outside the scope of Regulation 56AB in the course of which they supply electrical goods in pursuance of "contracts of work, labour and materials" and who did not undertake such work during the "basic period" must hold a licence under the Location of Retail Businesses Order, as well as a certificate under Regulation 56AB.

Electrical contractors who are not, for the purposes of Defence Regulation 56AB, "Building or civil engineering contracting undertakings" and who do not undertake work registrable under Defence Regulation 56AB, but who supply electrical goods in pursuance of contracts of work, labour and materials, must hold a licence issued under the Location of Retail Businesses Order in respect of each address from which they did not so trade during the "basic period" but they do not need a certificate of registration under Defence Regulation 56AB. (Within this category come, for example, such persons as "spare time contractors" who employ no full-time labour to assist them, and/or contractors who exclusively undertake work of, say, machinery installation and work not covered in the definitions.)

Those who supply electrical goods solely in pursuance of contracts to repair customers' own goods do not require a licence under the Location of Retail Businesses Order. Should such a business sell electrical goods, either new, second-hand or reconditioned, a licence will be necessary unless such sales were made during the "basic period" from the addresses now utilised.

In the case of retailers only a licence issued under the Location of Retail Businesses Order must be held in respect of each establishment opened since the "basic period."

"Building undertakings" include those consisting solely or mainly of the doing of work for the purpose of providing water, light, heating, or other services for a building. "Civil engineering contracting undertakings" are those carrying out a number of civil engineering works, including the doing of work for the purpose of providing water, light, heating or other services for any such works as are mentioned in this sub-paragraph.

Fluorescent Lamp Installations

Several members of the E.C.A. have recently raised the question as to what part of fluorescent lighting installations comes within the licensable limit under the Control of Civil Building Order. Mr. Penwill says that the Ministry of Works has ruled that the installation of this form of lighting is licensable, but that it is not necessary to include the cost of the fitting (*e.g.*, discharge lamp and control gear) in the cost of the work to be licensed. This ruling applies whether the control gear is housed in the fitting or whether it is separated from it (for instance, in a corridor adjoining the room in which the fitting is placed).

Portable Electric Tools

A short time ago Mr. Penwill advised his members regarding precautions which might be taken in respect of employees who were called upon to use portable electric tools. He now says that this advice has been resisted by the E.T.U. The matter has been further considered and the Association recommends that it would be of considerable assistance to members in meeting any difficulty which may arise if a label were affixed to all electric tools with the following inscription:—"This equipment may be used only by the employees of . . . and while it

is in use *it must be earthed*." The suggested wording, in addition to giving an effective warning, prescribes that the tool is provided by the employer for use only by his employees.

Non-earthed Appliances

The advice of the Association is frequently sought by members who are asked to repair various electrical appliances in which there is no provision for earthing. If a member who is presumed in law to be qualified to give service to the public returns such an appliance having carried out the work for which it was sent to him, it can be argued that a responsibility devolves upon him to give proper advice as to its installation. The Association has prepared wording which it suggests should be applied to every piece of such apparatus which passes through the hands of members; it is as follows:—"*Important*: This apparatus has no provision for earthing. Consult your electrical contractor before installing."

Tie-on labels are ineffective, as they can easily be removed by the customer and it would be difficult to prove that they had been affixed; it has therefore been decided that water transfers should be available to members, to be supplied by the Association at cost, should the requirements of the membership justify this. Members are asked to state the number of water transfers which they would wish to purchase, so that the necessary order can be placed.

Forthcoming Events

Saturday, May 12th.—*Cardiff.*—Physics Department, University College, Cathays Park, 2.30 p.m. Institute of Physics (South Wales Branch). "Use of Infra-red Radiation in Medicine," by Prof. W. V. Mayneord. (Open to visitors.)

Manchester.—At Engineers' Club, 3 p.m. Association of Supervising Electrical Engineers (Manchester Branch). Branch annual report.

Leeds.—Yorkshire Hussar Hotel, Eastgate, 1.15 p.m. I.E.E. North Midland Students' Section. Luncheon. The annual meeting will be held at the Electricity Department's Offices, Whitehall Road, at 2.45 p.m., followed by a film show.

Monday, May 14th.—*London.*—Institution of Electrical Engineers, 7 p.m. London Students' Section. "AC Generator Protection," by D. S. Daoud (to be read by P. W. Castle and G. Lyon).

Nottingham.—Corporation Gas Showrooms, Parliament Street, 6 p.m. Nottingham Society of Engineers. Films of engineering interest. Compère, M. A. Crosbie. (Date altered from May 21st.)

Tuesday, May 15th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Radio Section. Discussion on "The Characteristics of Luminescent Materials for Cathode-Ray Tubes," to be opened by C. G. A. Hill.

London.—At Institution of Mechanical Engineers, 5 p.m. Illuminating Engineering Society. Annual general meeting and (5.30 p.m.) address on "Daylight and its Penetration into the Sea," by Dr. W. R. G. Atkins.

London.—Lighting Service Bureau, Savoy Hill, 6.15 p.m. Association of Supervising Electrical Engineers. Winning entries in Branch papers competition.

Wednesday, May 16th.—*Cardiff.*—Park Hotel, 1 p.m. Radio Industries Club of Wales and Monmouthshire. Luncheon address by W. E. Warrilow, M.I.E.E., on "Radio—Past, Present and Future."

Thursday, May 17th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. (tea at 4.45 p.m.). Repetition of Kelvin Lecture on "The Scientific Principles of Radiolocation," by Sir Edward Appleton, K.C.B., F.R.S.

London.—At Institution of Structural Engineers, 11, Upper Belgrave Street, S.W.1, 6 p.m. British Institution of Radio Engineers (London Section). "Measurement of Cable Characteristics at Ultra-high Frequencies," by F. Jones and R. Sear.

Friday, May 18th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Measurements Section. Lecture on "Magnetic Materials," by Sir Lawrence Bragg, O.B.E.

Tuesday, May 22nd.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Radio Section. Discussion on "Non-Ferrous Contact Springs," to be opened by Dr. H. G. Taylor and Dr. L. B. Hunt.

Wednesday, May 23rd.—*London.*—Royal Society of Arts, Adelphi, 1.45 p.m. Thomas Howard Lecture: "Wire Broadcasting," by Paul Adorjan, A.M.I.E.E.

London.—At Institution of Mechanical Engineers, 6 p.m. Institution of Heating and Ventilating Engineers. "Heating by Electrode Boilers Without Thermal Storage," by J. Jamieson, B.Sc. (Eng.), A.M.I.E.E.

Saturday, May 26th.—*Birmingham.*—Grand Hotel. Birmingham Electric Club. Luncheon.

Scientific Advisory Committee

THE Minister of Works has appointed a Scientific Advisory Committee, under the chairmanship of Prof. J. D. Bernal, M.A., F.R.S., Professor of Physics, Birkbeck College, University of London. The Committee, which held its first meeting on May 2nd, is to advise on and to suggest lines of scientific research in relation to matters for which the Minister of Works is responsible; to suggest, having regard to existing research organisations in Government Departments, universities and industry, where this research could best be carried out and to keep it under review to ensure that it is properly correlated; and to advise on the practical possibilities and further development of the results of current research and to review the results of such development. Professor P. M. S. Blackett, M.A., F.R.S., Professor of Physics, University of Manchester, is among the members of the committee.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

K. S. ADIE.—" Fittings for electric lamps." 9338. June 10th, 1943. (568702.)

H. Allday & Son (1922), Ltd., and R. Bain.—" Electric switches." 19722. November 25th, 1943. (568719.)

Automatic Telephone & Electric Co., Ltd., E. Frydman and G. H. F. Seiflow.—" Contact spring sets for electrical switching devices." 16760. October 13th, 1943. (568750.)

British Insulated Cables, Ltd., T. Broadbent & Sons and F. Broadbent.—" Method of and apparatus for impregnating articles and materials with liquid." 14544. September 6th, 1943. (568766.)

British Iron & Steel Corporation, Ltd., and A. Douglas.—" Electro-magnetic apparatus for measuring and indicating small displacements." 8916. June 3rd, 1943. (568701.)

British Thomson-Houston Co., Ltd. — " Means for regulating power factor and voltage n alternating current circuits." 16197/42. November 25th, 1941. (568689.) " Noise suppression circuits for radio receiving apparatus and the like." 8205/43. May 23rd, 1942. (568697.) " Radio receivers." 12699/43. August 6th, 1942. (568747.) " Speed control arrangements for induction clutches." 13835/43. August 26th, 1942. (568760.) " Mount structures for electric lamps and similar devices." 13836/43. August 26th, 1942. (568761.) " Electric temperature control apparatus." 16105/43. October 1st, 1942. (568827.) " Condenser boilers." 18289/43. November 4th, 1942. (568841.)

C. O. Browne.—" Electrical devices and circuits for producing alternating currents with a desired phase." 1757. January 29th, 1940. (568785.)

H. O. Burge, J. C. M. Sanders and Crompton Parkinson, Ltd.—" AC commutator motors." 14541. September 6th, 1943. (568823.)

C. A. V., Ltd., and T. Curzon.—" Thermostatic switches for controlling electric circuits." 16149. October 1st, 1943. (568714.)

R. M. Chamney.—" Electrical cable manufacture." 16335. October 5th, 1943. (568775.)

J. A. Crabtree & Co., Ltd., and R. W. Morgan. — " Multi-position electric tumbler switches." 18137. November 2nd, 1943. (568837.) Enclosed electric tumbler switches." 18138. November 2nd, 1943. (568838.)

R. H. Crouch.—" Apparatus for the electrical treatment of water." 9789. June 17th, 1943. (568707.)

E. L. Damant.—" Measurement of electric current and more particularly current of a short or transient duration." 14205/43. November 3rd, 1942. (568765.)

Electrocraft, Ltd., and W. D. Rosenberg.—" Electrical connectors." 8768. June 1st, 1943. (568699.)

English Electric Co., Ltd., and H. S. Carnegie. —" Electromagnetic slip coupling arrangements for controlling the speeds of boiler auxiliaries and of other rotating devices." 10548. June 29th, 1943. (568730.)

Evershed & Vignoles, Ltd., and D. D. Walker. —" Mechanism for the electrical actuation of engine controls and like controlled elements." 13539. August 19th, 1943. (568758.)

General Electric Co., Ltd., and S. W. Richards.—" Electric terminals." 14885. September 10th, 1943. (568767.)

General Electric Co., Ltd., and W. G. Thompson.—" Systems comprising an alternator and a rectifier fed thereby." 13989. August 27th, 1943. (568762.)

Krebs & Co.—" Mercury cathode electrolytic cells." 11135/43. July 1st, 1942. (568735.)

Laurence, Scott & Electromotors, Ltd., W. Clarke and E. Barraclough.—" Control arrangements for induction regulators." 16617. October 11th, 1943. (568780.)

J. Lucas, Ltd., and R. L. Neill.—" Electric lamp bulb-holders." 11951. July 22nd, 1943. (568738.)

Marconi's Wireless Telegraph Co., Ltd.— " Voltage indicators." 14104/43. August 29th, 1942. (568821.) " Circuit arrangements for generating signals suitable for automatic frequency control." 15977/43. September 29th, 1942. (568825.)

Mawdsley's, Ltd., C. W. H. Minchin and A. J. Parsons.—" Dynamo-electric machines." 16454. October 7th, 1943. (568778.)

Micafil, Ltd.—" Machine for winding the stators of electric motors." 10978/43. June 19th, 1942. (Addition to 563932.) (568733.)

F. Moss.—" Electrical equipment associated with the traction motors in electric rail vehicles." 16989. November 30th, 1942. (568817.) " Methods of and apparatus for controlling electric motors." 18669/43. November 30th, 1942. (Divided out of 568817.) (568847.)

M-O Valve Co., Ltd., and H. S. Smith.— " Capping of thermionic valves, electric lamps and like devices." 8420. May 26th, 1943. (568698.)

S. Newberry.—" Electric master switches or electrical timing devices for controlling the operations of laundry or other plant or apparatus." 10799. July 2nd, 1943. (568732.)

Okonite-Callender Cable Co., Inc.—" Electric cable systems." 16377/43. November 25th, 1942. (568777.)

Power Equipment Co., Ltd., and H. C. Heath.—" Electrical magazine fuses." 16595. October 11th, 1943. (568779.)

T. R. Rider and R. W. Wassell.—" Electric immersion heaters." 12011. July 23rd, 1943. (568806.)

F. Sauter Akt.-Ges. Fabrik Elektr. Apparate. —" Electric regulators." 6337/43. May 7th, 1942. (568796.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—" Electric discharge lamps." 13665. August 21st, 1943. (568810.)

Standard Telephones & Cables, Ltd.— " Device for coupling two high-frequency electrical circuits." 17462/43. August 15th, 1942. (568831.)

M. Strode (G. Hagerup-Larssen).—" Self-

baking electrodes for electric furnaces." 16353. October 6th, 1943. (568776.)

Telephone Manufacturing Co., Ltd., and C. O. L. Ward.—"Attachment of ceramic insulators to metal containers or sheet metal supports." 16965. October 15th, 1943. (568715.)

K. Wessely.—"Capacity and inductance measuring apparatus." 17701. October 27th, 1943. (568836.)

Westinghouse Electric International Co.—"Voltage regulating systems for electric current converting systems." 12750/43. August 6th, 1942. (568748.) "Induction heating coils." 17296/43. October 31st, 1942. (568830.) "Elevator control systems." 18212/43. November 4th, 1942. (568839.)

A. G. Williamson and Metropolitan-Vickers Electrical Co., Ltd. — "Dynamo-electric machines." 9274. June 9th, 1943. (568803.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Adwick-le-Street. — May 19th. U.D.C. Electricity Department. E.h.v. steel-wire armoured and l.v. steel-tape armoured cables; 250-kVA indoor transformer; and substation distribution panel. (May 4th.)

Australia. — PERTH. — June 21st. Government of Western Australia. Switchgear, motor-generator sets and batteries. (May 4th.)

Birkenhead.—May 14th. Electricity Department. Cables, meters and general stores. (April 27th.)

Dunbar.—June 9th. Town Council. Supply and installation of street lighting equipment including poles, lanterns, wiring and control gear. Specs. from burgh surveyor.

Long Eaton.—May 12th. Electricity Department. H.v. switchgear. (April 27th.)

Salford.—May 26th. Electricity Department. Thirty-six steel street lighting standards. (May 4th.)

Swansea. — May 16th. Waterworks Department. Supply and erection of electric pumping plant. (May 4th.)

Orders Placed

Aberdeen.—Electricity Committee. Recommended. Boilers for the electricity works (£131,000).—Yarrow & Co.

Bolton.—Electricity Committee. Accepted. Steam pipes, pumps and valves.—Stewarts & Lloyds. Stoker-fired boiler complete with auxiliaries. — Babcock & Wilcox. L.v. auxiliary switchgear.—Metropolitan-Vickers.

London.—Joint Electricity Authority. The following contracts have been extended for twelve months:—Cable.—Crompton Parkinson; Connollys (Blackley); Hackbridge Cable Co. Electrical accessories.—Drake & Gorham Wholesale.

Manchester. — Electricity Committee. Accepted. Battery for stand-by to DC auxiliary machinery. — Chloride Electrical Storage Co. Automatic voltage variation equipment and reactors. — Metropolitan-Vickers. 500-kW mercury arc rectifier equipment.—Hewittic Electric Co. (Sub-contractors for transformer.—Hackbridge Electric Construction Co.) DC switchgear. — Bertram Thomas (Engineers).

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bexhill. — Restoration of De La Warr pavilion (£15,443); borough engineer.

Birkenhead.—Hospital for children, Wexford Road; borough engineer.

Rebuilding Christ Church School; managers.

Houses, Vyner estate (£25,239); Lloyd & Cross, Ltd.

Bolton.—Boiler house, Adelaide Street; Rutland Mills Co., Ltd.

Bournemouth.—Works additions, Pine Road; Austin & McLean.

Restaurant, Holdenhurst Road (£2,173); Clarincrete, Ltd.

Cheshire.—Primary and junior schools at Grange estate and Old Timperley Village; E. M. Parkes, county architect, The Castle, Chester.

Hull.—Temporary shops, Bilton Grange estate; city architect.

Huntingdonshire.—Farm institute, Alconbury; county architect, Walden House, Huntingdon.

Isle of Ely.—Dining hall and kitchen (£7,603), Hereward School, March; R. D. Robson, county architect, County Hall, March.

Lanarkshire.—Additional garage accommodation at Bellshill for County Council (heating and electrical installation); W. R. Watt, county architect, 34, Albert Street, Motherwell.

Lancashire.—Huts at Stretford, Bacup and Chorley schools (£4,400) and extensions to police station, Seaforth (£3,000); county architect, Lancaster.

London.—ST. MARYLEBONE.—Shops and flats, Church Street site; Stanley Hall & Easton & Robertson.

Northants.—Extension of Monotechnic Institute, Corby (£8,500); county architect, County Hall, Northampton.

Oxford.—Extension of joint tuberculosis sanatorium; borough engineer, Municipal Buildings, Oxford.

Wallasey. — School kitchens; borough engineer.

Warlingham (Surrey). — Laundry buildings, Farleigh Road; Crew Bank Laundry, Ltd.

Warrington. — Sanatorium extensions after the war (£60,000); borough engineer.